Monsanto

Phase II Remedial Investigation Report for the Soda Springs Elemental Phosphorus Plant Volume II

Prepared by:



and



AR 2.5



41182

Appendix A

Monsanto Phase II PI Vol. 2

AR 2.5

sdws#41182

APPENDIX A LETTERS

United States Environmental Protection Agency Region 10 1200 Sixth Avenue Seattle WA 98101 Alaska Idaho Oregon Washington



June 15, 1992

In Reply

Refer To: HW-113

Robert L. Geddes Senior Environmental Engineer Monsanto Chemical Company P.O. Box 816 Soda Springs, ID 83276

Post-It brand fax transmittal	nemo 7671 de anoma de 170
PANIA BANTON	From Tim Zonicohil
Dept	EPA
Fex # C.C.	Pax s . 553-2100

Subject:

Phase I Remedial Investigation/Feasibility Study Preliminary Site Characterization Report for the

Monsanto Soda Springs Facility

Dear Mr. Geddes:

The purpose of this letter is to acknowledge your timely submission of the Preliminary Site Characterization Summary Report and to transmit EPA's comments on the report to you (please see enclosure). The Report submitted on April 23, 1992 was responsive to the work plan, well-written, and organized in a fashion that was relatively easy to follow in most places. The air pathway/emissions discussions were the most difficult to review and evaluate due to the lack of complete supporting information for the assumptions and conclusions discussed in the report.

General and specific comments to the document are provided on the enclosed pages. The general comments reflect major issues of concern that could affect Phase II planning and development. The specific comments deal primarily with explanation and clarification of particular topics, some of which must be addressed in Phase II planning and some of which merely need to be addressed in future Remedial Investigation (RI) reports.

By this letter, EPA is also proposing a change in the Work Plan in order to keep the project moving and avoid duplication of effort. Rather than have Monsanto revise this preliminary Report, EPA proposes that Monsanto acknowledge and respond to EPA's comments in a memo within three weeks of receipt of these comments and subsequently incorporate any necessary changes in the Phase II Work Plan, during Phase II, and/or in the draft RI report as appropriate. If this is acceptable to you, please acknowledge your agreement with this change in your response letter.

If you have any questions about this letter or the enclosed comments, please call me at (206) 553-2100 and we can either discuss them at that time or put them on the agenda for our meeting on June 17, 1992.

Sincerely,

Timothy H. Brincefield Superfund Project Manager

Enclosure

CC: Kevin Oates, EPA Superfund
Charles Ordine, EPA ORC
Christine Psyk, EPA Superfund
Lorraine Edmond, EPA ESD
Don Matheny, EPA ESD
Gordon Brown, IDHW
Mike Thomas, IDHW
Jim Eldridge, SAIC
David Banton, Golder Associates

EPA COMMENTS on the MONSANTO CHEMICAL COMPANY PRELIMINARY SITE CHARACTERIZATION SUMMARY REPORT

COMMENTS ON THE DOCUMENT IN GENERAL:

1. Evaluation of the vadose zone as part of the pedological investigations was incomplete. It was stated on page 23 (Section 2.5) that the vadose zone beneath potential sources will be evaluated for potential to affect ground water quality. Potentially affected vadose zone areas were not discussed in Section 3.5 nor specifically discussed in Chapters 4 or 5. The report states that the sewage evaporation ponds may affect the ground water quality, and that the old underflow solids ponds affect ground water quality; however, an evaluation of vadose soils in these areas is absent. It is also possible that the ground water may be affected by material or residuals from the old coke and quartzite slurry pond which did not have a liner. Other potentially affected vadose areas should include the Northwest Pond and the active underflow solids stockpile.

The Monsanto Work Plan (page 51) states that vadose zone contribution to ground water quality will be determined from geochemical equilibria evaluations and ground water data with the assistance of certain models. The SCR states that fluoride concentrations have reached equilibrium at the site without providing documentation or supporting information.

Since data obtained during the Phase I investigation suggest that portions of the site contain covered and closed impoundments and that these areas in the vadose zone are potential sources for contaminant loading to ground water, it is recommended that additional evaluation of soils beneath the impoundments be performed during Phase II to determine their contribution to ground water quality.

The types of information necessary for vadose zone evaluation may include detailed discussions of contaminant fate and transport in subsurface soils, distance from the bottom of source areas to the water table, the hydraulic conductivity in soils beneath the impoundments, evapotranspiration rates and the associated aquifer recharge resulting from the infiltration of precipitation, and a few soil samples down to the water table from selected areas.

2. In order to establish common background values for screening purposes for both Soda Springs Superfund sites, EPA directed Monsanto and Kerr-McGee to each take 3 off-site background samples from agreed-upon locations and then to use the data from all six locations to establish background. The SCR report includes only the 3 samples taken by Monsanto. For Phase II, Monsanto should add the additional 3 data points and re-evaluate which analytes are elevated with respect to background. The Work Plan should include

a chart showing, at a minimum, the range, mean, and standard deviation of background samples (n=6, the same 6 samples used by Kerr-McGee) alongside the range, mean, and standard deviation of site samples. In addition, several methods of comparison between background and site concentrations should be shown.

the appropriate statistical method to evaluate elevation with respect to background at this Superfund site. EPA does not recommend or have a single approved statistical method for this type of screening at Superfund sites. Rather, EPA prefers to use several different standards for comparison, such as the background mean, the mean plus 1 or more standard deviations, and/or broader regional values, in order to accurately screen for elevation with respect to background. EPA has no objection to being one of the comparisons used by Monsanto, but others should be used as well (for example, Kerr-McGee used the background mean plus two standard deviations was used as one comparison value and a very broad "western U.S." concentration range as a second comparison).

- 3. The rationale for selection of background ground water wells was incomplete or confusing. For example, Well TW-02 was selected as a background well even though some of the constituents in the ground water at this location have historically exceeded risk-based levels. In addition, the concentration of zinc in this well was excessive compared to the other background wells. The selection of these wells should be reconsidered as decisions are made for Phase II, and whatever decisions are made should be more fully documented in the Draft RI.
- 4. The screening tables used to identify elevated constituents in the ground water (Tables 4-14 and 4-15) used only the maximum filtered concentrations. While filtration of ground water samples provides useful information for understanding chemical transport within an aquifer, it is critical to measure the chemical concentrations as they relate to potential exposure. Large differences in constituent concentrations (up to 3 orders of magnitude higher) exist between unfiltered and filtered samples.

Risk Assessment Guidance for Superfund (RAGS) recommends an adequate evaluation of such differences, prior to identification of potential contaminants of concern based on filtered data since it cannot be assumed in future exposure scenarios that all ground water consumed will be filtered with a 45 μm filter. In order to assist with preparation of the Risk Assessment, Monsanto must provide EPA with such an evaluation during Phase II.

5. The Mead Thrust Aquifer System is not adequately addressed in this report. At least five Monsanto Wells with elevated levels of constituents occur in this system, along with several off-site springs. An understanding of the vertical and horizontal contaminant plume in this system, especially in the eastern portion

of the Monsanto site, is necessary to evaluate potential remedial actions that may be necessary. Since the Mead Thrust Aquifer System mixes with the Shallow Ground Water Zone (as described on page 63) and the Lewis Well has elevations of chemicals similar to plumes emanating from both the Monsanto and Kerr-McGee sites, further evaluation of this aquifer is warranted. A "regional" approach to characterizing the plume in this system may be necessary through joint information sharing and gathering from both Monsanto and Kerr-McGee. The Phase II Work Plan should address how the Mead Thrust Aquifer will be more thoroughly characterized in Phase II in order to complete the RI.

- 6. It was stated in various sections of the report that characterization the UBZ-2 zone south of the Plant is inadequate and further information is required. The Phase II Work Plan must include plans to further characterize plumes migrating off-site through activities such as the installation of wells south of the Plant, aquifer testing, and chemical sampling. Data should also be collected to determine influences of the fault structures on ground water flow south of the Plant.
- 7. The SCR presents a limited assessment of air quality impacts from the site. The report evaluated TSP and PM10 impacts along with an incomplete assessment of fluoride and cadmium impacts from the site. As indicated in section 6.2.2.1 of the report, additional site characterization must be done in Phase II to identify applicable sources and constituents of concern and to determine the significance of the air pathway at the site.
- 8. Tracking the numerous assumptions, data, and calculations involved with the air pathways and air transport analyses presented in Sections 5.3.1 and 5.3.2, respectively was very difficult. In addition, since much of the supporting information that Golder Associates and SENES Consultants used apparently was derived from material and personal communications from Mr. Don Wind (Memorandum in Appendix A), the quality of the data used is unknown. Several examples illustrate these points:

Many of the emissions estimates from certain sources or source areas used in the dispersion modeling analysis are significantly lower than the estimates used in earlier work conducted in 1988 (e.g. nodule crushing area and slag pile). Unfortunately, much of the data needed to support such changes are lacking in this submittal.

The concentrations of cadmium and fluoride used in the TSP fraction emission rates are not provided in the Appendices for review. The concentrations and moisture content data used on pages 141 and 142 are apparently based on unverified 1990 data, which differs from some of the RI/FS data in Appendix B. Similarly, the percent silt contents for the active storage piles presented on page 145 conflict with the RI/FS data in

Table 3-2.

The nodule crushing/screening scrubber outlet emissions was not discussed on page 133; however, Table 5-1 and a memo in Appendix A indicate emissions to be 9.7 lbs/hr. In addition Table 5-1 does not calculate fluoride apparently due to lack of data. However, on page 141, the fluoride concentration in nodule fractions was given as 0.00715. (The cadmium value was the same on page 133 and 141).

The cadmium and fluoride fractions used in the calculations of baghouse emissions were not provided in Section 5.3.1.2.

The control or collection efficiencies of the various scrubbers, baghouses, and other fugitive dust collection operations appear to represent peak efficiencies and thus somewhat optimistic. Supporting data should be provided.

It is unclear why Tables 5-16 and 5-20 do not have numerical values for predicted cadmium concentrations in the air resulting from nodule reclaim and slag dumping operations, even though data is available for the calculations involved.

This background needs to be provided to EPA as soon as possible, preferably with the addition of the most recent (1991) data (see Specific Comment #3), to allow EPA to evaluate Phase II proposals. The air pathways discussions in the RI report will have to be much more thoroughly documented.

- 9. Rationale should be provided in the Phase II Work Plan for the elimination of other constituents in the evaluation of air quality. Phase II investigations should include any recent stack sampling results, and air modeling should be performed on those constituents of concern that were identified in off-site soils. In addition, further evaluation of emissions emanating from the nodule reclaim area and the slag dumping operations should be conducted during Phase II.
- 10. The SCR air analysis estimates only ambient air concentrations available for the inhalation exposure pathway. There is no way of estimating potential chemical deposition associated with current or past operating practices. While the presently planned soil sampling effort will provide information related to the deposition of site-related emissions, it may prove necessary to distinguish between those materials deposited from past practices and those attributable to current operations. If sufficient information is not otherwise available to characterize the site, deposition modeling should be conducted to evaluate the amounts of emitted constituents of concern deposited on soil/vegetation surfaces in the vicinity of the site. Deposition modeling may also provide a means of evaluating the fluoride-in-vegetation monitoring reports of 1985 through 1988, as they relate to emissions generated at the

site.

11. The SCR report fails to address any air quality-related impacts (e.g. fluoride and cadmium emissions) associated with past operating practices at the site. This issue must be considered during planning for Phase II and, at a minimum, will need to be addressed thoroughly in the draft/final RI. If processes/practices have changed during the history of operation, then such changes should be evaluated to determine their potential contribution to elevation of constituents of concern in off-site soils.

COMMENTS ON SPECIFIC PAGES:

- 1. Page 39, Section 3.2.1: The modeling described in the SCR was based on one year of meteorological observations collected during 1990. As data from 1991 are now available, an analysis of 1990 and 1991 meteorological data should be performed and presented to EPA as soon as possible, and should be documented in the draft RI. This analysis should include a discussion as to how the variability and seasonality of the data may affect emission estimates.
- 2. Page 41, Paragraph 5: The modeling analysis employs mixing height data gathered at Boise. Upper air data collected at Salt Lake City (SLC) would have been more appropriate for use because SLC is physically closer to Soda Springs than Boise, and more importantly, SLC and Soda Springs are closer in elevation than are Soda Springs and Boise. For ongoing work at similar sites in Pocatello, ID, EPA has approved the use of SLC data for modelling. EPA recommends that Monsanto use mixing heights from SLC in any future modeling analyses.
- 3. Page 58, Section 3.6.2.1. A review of the well logs and historical data indicates that the role of the transmissivities of flows and interflow zones accurately defined. The results of the aquifer testing done in 1984 are equivocal. For several of the tests it was noted that there was no measurable drawdown in observation wells when PW2 and PW3 were pumped. Several possible explanations were noted for the lack of drawdown observed: an anisotropic ground water system, a hydraulic barrier or the steeply sloping water table preventing full propagation of the cone of depression (Golder, November 1985). Furthermore, four of the wells on which the aquifer testing was performed were found to have poor seals, compromising the results. Only two of the 10 wells tested were screened completely in the basalt. It should also be noted that the well with the highest transmissivity was screened in the LBZ; however, it was one of the wells abandoned because of the poor seal.

It appears there is insufficient data to confirm the assertion that the faults act as barriers to flow and that there is no hydraulic connection between the UBZ and LBZ. More extensive hydraulic

testing done by Kerr-McGee found that the conductivity of the flows and interflow zones was similar. This issue must be more fully addressed in the draft ki. As part of Phase II, Monsanto should propose whatever additional work is necessary to more accurately define the characteristics of the aquifer, especially south of the Plant (See general comment \$5). This could include performing additional pump tests, installing some new wells screened in the basalt flows and in the interflow zones, or some alternative means of addressing this data gap.

- 4. In Table 3-15, well TW-29 was placed in the sodic water group; however, it has a Ca/Mg ratio greater than one, unlike the other wells listed and substantially lower bicarbonate and specific conductance values. Nitrate/Nitrite as N is much higher than other "sodic" wells and springs. These values are closer to the "fresh" wells than the sodic. TW-28 also has a Ca/Mg ratio greater than one, but other parameters are similar to the "sodic" wells. Since these wells are also used as background sodic wells. These issues should be considered during Phase II planning and if no changes are made, Monsanto should provide further clarification for why these wells were placed in the sodic system in the draft RI.
- 5. Page 63, paragraph 2. It is stated that TW-10 water is sodic water with recent infiltration from fresh water accounting for the young age (among the youngest tested) and elevated tritium levels. However, oxygen-18 and deuterium values are almost identical to those for Doc Kackley and Hooper Springs which are sodic water only. Since review of the general chemistry of TW-10 shows that it does not fit the "sodic" water profile, Monsanto should provide an explanation for the variance in some parameters and not in others in the draft RI.
- 6. Page 64 Ground Water Flow Characteristics, UBZ-5
 The report states that "based on existing hydrogeologic information, Ledger Spring is not downgradient of any potential sources at the Monsanto Plant, and based on age-dating is not threatened by plant activities." This is an important conclusion which must be discussed in more detail in the next RI report and more explicitly connected to the hydrogeologic information to which it refers.
- 7. Page 68 Ground Water Use
 The report refers to a former drinking water well at KMCC that is now abandoned. It was my understanding that KMCC formerly used their production well as a drinking water well, then later connected to the Soda Springs City water supply. The final RI Report should include a figure outlining the zone subdivisions (LBZ 1-4, UBZ 1-4).
- 8. Page 82 A benchmark of 0.5 Hazard Index is used as a primary screening criterion. This assumes that there are no other pathways for those contaminants. Region X guidance uses a Hazard Index of

- 0.1 for screening when other potential pathways exist. This should be reevaluated during Phase II planning and discussed in the RI report.
- 9. Page 87, Section 4.4.2. The screening procedure used for constituents of potential interest is human health risk-based and does not necessarily reflect ecological risk-based levels to plants and wildlife. This should be clearly documented in the RI report.
- 10. Page 88 and 89. An RF factor is given as a multiplier of the air particulate data to obtain the "respirable fraction". The toxicological assumption that 25 percent of the TSP is retained in the lungs is debatable. EPA guidance suggests the collection of PM-10 data for assumptions regarding the respirable fraction. The air pathways and air transport analyses modeled PM-10 levels for cadmium and fluoride. The recommendation for sampling of particulates from the IDHW stations in Phase II may provide information of TSP and PM-10 levels. If not, Moinsanto should propose an alternative method to collect the necessay information.
- When discussing the interpretation of data from filtered samples, the report states that "a filtered sample... overestimates the dissolved constituent in a water medium as ... about half of all colloidal particles present (i.e., those less than 45 mm in size) are represented in the sample." One of the objectives of locking at data from filtered samples is to evaluate the fraction of the constituents that is mobile in ground water. Because filtering removes some of the colloidal particles, it may result in an underestimate of the mobile fraction. The relevant section of the Draft RI should discuss both sides of the filtered/unfiltered question.
- 12. Table 4-10. Noncarcinogenic Reference Doses. Several RfDs in this table are incorrect, including:

The RfDs for chromium (III) and chromium (IV) are 10 and 200 mg/kg/day, respectively, as reported in the HEAST Tables. Golder references last year's HEAST Tables, and reports an unspeciated chromium RfD of 1.0 mg/kg/day.

The report assigns an inhalation RfD (noncarcinogenic) of 0.0001 mg/kg/day for manganese. The current HEAST tables report it as 0.0004 (Four times higher).

For cadmium, the SF is given as 6.3 mg/kg/day in this table, but the value from HEAST is given as 6.1 mg/kg/day.

Monsanto should review the RfD values and factor the correct values into planning for Phase II. A corrected table should be provided in the RI.

- 13. Table 4-16. Nitrate/Nitrite (as total N) is given an RfD value of 1.6 (Reference is listed as IRIS), but the HEAST Tables list the same parameter as a value of 0.1, which is 1/16 of the value listed by Golder. Monsanto should review this RfD and factor the correct value into planning for Phase II. A corrected table should be provided in the RI.
- 14. Page 96, paragraph 1. Manganese, chloride, and sulfate were eliminated from further consideration even though these constituents frequently exceeded drinking water standards (SMCLs). Monsanto should reconsider these constituents during Phase II planning and at a minimum, a discussion of the frequency and magnitude of such exceedances of SMCLs and how they may affect human health should be included in the RI.
- 15. Page 108, paragraph 4. The inhalation of off-site particulates from Plant emissions may not necessarily overwhelm the inadvertent ingestion of off-site soils without an analysis to determine the incremental exposures from each pathway. This increment will be examined in the risk assessment process.
- 16. Page 111, paragraph 3. Ground water could potentially be used for stock watering purposes and thus represent a potential biotic pathway. This will be evaluated during the risk assessment and should be mentioned in the RI report.
- 17. Pages 132 and 133: Percent fractions of TSP for several sources are presented. It is difficult to determine whether these are TSP fractions of total particulate emissions or if they are PM_{10} fractions of estimated TSP emissions. Review of the references identified did not clarify what those values represent. This should be clarified in the draft RI.
- 18. Page 135, paragraph 4: The technical basis for the factor used to estimate emissions from slag dumping is not well substantiated in the report. The 0.026 lb/ton TSP emission factor is intended to represent the loading of cooled, broken slag into trucks with front end loaders. This factor does not appear appropriate for estimating emissions released when molten slag is poured. The technique employed in 1988 appears to more reasonable, as it incorporates a slag pouring factor directly, and adjusts this factor to account for pouring outside of the building. The discussion indicates that modeling using the 1988 emissions estimation approach resulted in predicted concentrations at the Harris Ranch site from slag dumping alone which exceeded the observed effects from all Monsanto sources and therefore that approach was inappropriate. It is not clear how the "observed effects" from all Monsanto sources was determined. An emission factor appropriate for the slag pouring process should be used in future modeling analyses, and this discussion needs to be clarified in the draft RI.

- 19. Page 136, Paragraph 5: The report identifies two emission factors for fluoride emissions from slag pouring; one from an EPA report and another "published" factor. The "published" factor (which is used in this analysis) results in emissions which are significantly lower than earlier 1988 estimates. The "published" factor is referenced with a citation of the missing (or non-existent) April 18, 1990 memo discussed above. The appropriateness of this factor cannot be determined without suitable documentation.
- 20. 'Page 138, paragraph 1. The report claims that the ASA (1990) emissions test results are not reliable for estimating emissions from the reclaim hopper. Unfortunately, the ASA report is not included to substantiate this claim. The technique used in this analysis results in significantly lower emissions than indicated by ASA.
- 21. Page 141 & 144: Particle size distributions other than \leq 30 μ m (fraction 0.74) were collected for phosphate ore, treater dust, baghouse dusts, underflow solids, and slag (Appendix B); however, only the 0.74 fraction was used in the equations on page 141 and provided. Further clarification should be
- 22. Page 142 and 143: The unpaved roadway dust emissions equations contain an incorrect factor to account for precipitation. The correct factor ((365-p)/365) should be used in the RI report.
- 23. Page 145, paragraph 3: Windblown dust emissions from storage piles are reduced by a factor of 120/365 to account for snow cover during the winter. Application of this factor appears to result in some double-counting of reductions since the precipitation factor contained in the equation embodies snowfall as well as rain. A more appropriate adjustment factor should be incorporated into future analyses.
- 24. Page 147: The dispersion modeling failed to address impacts resulting from complex (and intermediate) terrain. Because the site is situated in the vicinity of significant terrain features, during Phase II and in the RI impacts (particularly from point sources) should also be evaluated using appropriate complex terrain modeling techniques.
- 25. Table 5-11: This table shows that emissions from roads rank third (28.5 tons/year TSP). Concentrations of cadmium and fluoride were not measured directly. However, since the majority of road emissions are from the slag, quartzite, and ore haul roads, conservative estimates could be made by using the concentrations in the source material dusts. These calculations should be made and incorporated in the analysis.
- 26. Page 146, paragraph 3. In order to narrow the uncertainty of emission rates, it could be assumed that the kiln spray tower and

the kiln venturi scrubbers operate at the same rate as furnace for at average furnace hours of operation (7,936 hours), rather than 8,760 hours per year.

- 27. Page 154, paragraph 5. An explanation should be provided as to why maximum fugitive emissions and resultant concentrations from Groups 2, 3, and 4 would only occur under neutral (Class D) conditions.
- Page 170, paragraph 6. It is stated that elevations of constituents in the lower basalt zone is due to communication caused by poor well construction at Wells TW-3 through TW-6. However, this does not account for the elevated levels (relative to background) recorded in wells in the center of the site, upgradient to Wells TW-3 through 6. Although contaminant levels have been decreasing in this area since the wells were grouted out, the metal and other inorganic compound concentrations are still the highest in the area of Wells TW-5 and TW-6 (page 59). The report states that ground water velocity in the LBZ ranges from 0.6 to 30 feet per day. If the wells were grouted out and the source removed at the end of 1986, the plume should have moved at least 10,950 feet downgradient from the source. The continued presence of elevated metals and inorganics in the LBZ suggests there may be a connection between the UBZ and LBZ and/or residuals remain. This must be considered during Phase II planning and addressed in the RI report.
- 29. Table 2-8. In the RI report, an explanation of the partially canceled parameters should be provided in the legend.
- 30. Appendix C, Table C-1. The units should be changed to mg/kg in the RI report.
- 31. Appendix K. Since Kerr-McGee developed a similar well inventory, it is encouraged that data be shared for a comprehensive listing and verification of area wells.
- 32. Page 173. Source Investigation.

 EPA concurs that additional source investigations are necessary to complete site characterization. Based on the SCR and our meeting on May 21, 1991, EPA understands that Monsanto is proposing to take additional samples from the potential source areas listed and analyze them for elevated constituents found in off-site soils plus cadmium and fluoride. This seems appropriate given the available information, but EPA is unable to determine at this time whether this will provide all necessary information to complete the air pathways analysis absent the supporting information discussed in General Comment #8. Monsanto should include plans for the additional source investigations in the Phase II Work Plan.
- 33. Page 173. Meteorological Investigation
 EPA concurs that 1991 meteorological data needs to be added to supplement the 1990 data and that additional modelling needs to be

- done following the additional source characterization work. This analysis should include a discussion as to how the variability and seasonality of the data may affect emission estimates. Constituents of concern in off-site soils should be correlated with contributions to the elevated levels of constituents of concern in soils should be evaluated.
- 34. Page 173. Surface Hydrological Investigation EPA concurs that additional sampling of Soda Creek sediments will help determine the extent of the constituents of concern. Phase II investigations must also evaluate the suspected pathways that result in elevated constituents in the sediments.
- 35. Page 173. Geological Investigation
 While it may be true that additional direct geological investigation is not required at this time, the geologic model in the RI report must be refined utilizing data from the Phase I investigation at Kerr-McGee and from data collected from Phase II off-site investigations. Development of a regional conceptual geologic model using this information would be useful as remedial alternatives are developed.
- FPA concurs that the areal extent of constituents of potential interest in off-site soils needs to be further defined and characterized. Phase II investigations should attempt to correlate the areal extent of constituents of concern with potential current and past releases from source areas. The focus of the activity should be in those areas where the greatest potentials for exposures may exist. Elevated levels of constituents in soils south, southeast, and northeast of the site were detected in the Phase 1 SCR. Air modelling data presented in the SCR also indicate elevated levels of constituents are to be expected south of the site. Consequently, Monsanto must include plans to investigate soils south and east of the facility in Phase II.
- 37. Page 173. Hydrogeological Investigation
 EPA agrees that additional assessment of the plume observed in UBZ
 2 needs to be defined beyond the facility boundary EPA also concurs
 that Monsanto should include Kerr-McGee data in order to develop a
 more regional conceptual hydrogeological model. However, Monsanto
 also needs to address the role of the Mead Thrust Aquifer system
 per General Comment #5. Additional characterization of the role of
 the faults, flows, and interzone flows should also be examined per
 Specific Comment #3.
- 38. Page 173. Ecological Investigation
 While EPA agrees with these recommendations, it will also be
 necessary to identify and evaluate potential environmental pathways
 and receptors exposed to constituents of concern in off-site soils.

Monsanto

APR 1 2 1988

E-LOCATION-PHONE

C. K. Cheng (4-6178)

MCC Environmental Systems - #2WJ

Worldwide Guideline #1

April 8, 1988

Air Dispersion Modeling

REFERENCE

TO

Fr R. Johannsen A3ND

cc. J. P. Hyland - G4WT

C. D. Malloch - A3NA

K. J. Perry - F2WJ

O. S. Ratterman - F2WJ

J. M. Schroy - F2WJ

J. H. Waldbeser - F2WJ

D. R. Wind - 1850

Enclosed are the results of IEM air dispersion modeling for Cadmium at Soda Springs.

Chi let Chy
c. K. Cheng

/jt

Enclosure

NNC - 0.05 ane - 0.00126

Transmittal of IEM Results to DMHS from Environmental Systems

Plant	Soda Springs			
Chemical	Cadmium			
Priority .	1			
	·			
Collectiv	e exposure (person	-με/m³)	17.5	
		r		
144		ntration (µg/m³) _	0.20	
WWXTWAN U	Abpenanting concer	, , , , , , , , , , , , , , , , , , ,		
•			0.05	
Nearest T	eighbor concentra	rion (#2/m³)		

Tables showing these values appear in the attached IEM printouts.

From C. K. Cheng
Date April 8, 1988

2085473312→ GOLDER ASSOCIATES:#10

MAY 1 7 1988

Monsanto

-LOCATIO	C. K. Cheng (4-6178)	MCC Environmental Systems - Fr
DATE :	May 16, 1988	G. D. Hyland - GAWT C. D. Malloch - A3NA
tuaject :	Worldwide Guideline #1 Air Dispersion Modeling	K. J. Perry - F2WJ O. S. Ratterman - F2WJ J. M. Schroy - F2WJ
appearact :	F. R. Johannsen - A3ND CCR	J. H. Waldbeser - F2WJ D. R. Wind - 1850

Enclosed are the results of IEM air dispersion modeling for HF at Soda Springs.

C. K. Cheng

/jt

Enclosure

From C. K. Cheng Date May 16, 1988

Transmittal of IEM Results to DMRS from Environmental Systems

Plant	Soda Springs		
Chemical	HP		
Priority	1		
Average	individual exposure (48/m³)	0.06
Maximum	hypothetical concentr	ration (Mg/m³)	32.8
Nearest	neighbor concentration	on (4g/n³) <u> </u>	7.6
Tables s	showing these values	appear in the	attached IEM printouts.

SENT BY: Xerox Telecopier 7020 ; 4-20-92 ; 15:08 ;

MONSANTO CONFIDENTIAL

Soda Springs

The information herein is current as of: June 22, 1988

Cadmium

There are no current federal ambient air standards for cadmium under the Clean Air Act. The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) of 100 micrograms of cadmium per cubic meter of air (100 $\mu g/m^3$) to prevent kidney and lung injury in workers. The American Conference of Governmental Industrial Hygienists (ACGIH) have proposed a Threshold Limit Value (TLV) of 10 micrograms per cubic meter (10 $\mu g/m^3$) to protect workers against kidney and lung injury and the risk of lung cancer.

Estimated routine plant emissions can be used with computer modeling to calculate an annual average air concentration of cadmium for the surrounding community as a whole and for specific geographic locations. These calculations can be used to estimate a hypothetical annual average exposure of the community and a higher maximum annual average concentration for some individuals because of variations in geographic and meteorologic patterns. The model does not precisely predict actual ground level concentrations because of variability in atmospheric conditions. These values are considered conservative, i.e., it has been demonstrated that such predicted air concentrations are higher than actual measured values. Also, continuous annual operation is assumed for these computer estimates. The emission numbers are thus worst case since no plant operation runs continuously over a full year. The emission numbers reported annually under Section 313 will not be greater

SENT BY: Xerox Telecopier 7020 ; 4-20-92 ; 15:09 ;

Cadmium - Soda Springs

Page 2

and likely be less. Nevertheless, these calculated ground level dispersion concentrations can be useful for planning and evaluation purposes.

Computer modeling provides the following information for assessment purposes. The estimated annual average community air concentration resulting from plant emissions is 0.0013 micrograms of cadmium per cubic meter of air $(0.0013 \ \mu g/m^3)$. For a simple comparison, the TLV proposed for workers by ACGIH is 7,700 times higher. Due to geographic and meteorologic variations, the higher estimated annual average air concentration for some individuals is predicted as 0.05 micrograms per cubic meter of air $(0.05 \ \mu g/m^3)$. The TLV level proposed by ACGIH is 200 times higher. In both instances, the substantial margins of safety over and above the occupational exposure level (TLV) proposed by ACGIH leads to a conclusion that routine plant emissions of cadmium will not produce kidney or lung injury in the community.

In its proposal, ACGIH concluded that persons exposed to cadmium below 10 micrograms per cubic meter of air (10 µg/m³) would not be at increased risk for lung cancer. Since there are differences in the exposure patterns of workers and neighborhood residents, the air concentrations of cadmium estimated by computer modeling can be adjusted to allow for those differences. When this is done, the ACGIH proposed level (TLV) of worker exposure is over 1,500 times higher than the estimated annual average community air concentration and about 40 times

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Cadmium - Soda Springs

Page 3

higher than the annual average air concentration for the most exposed individuals.

A single long-term inhalation study in animals has shown an increased incidence of lung cancer. An epidemiology study of workers exposed to high cadmium levels also showed a slightly increased level of lung cancer. Further research is needed to determine the significance to humans of exposures at much lower levels which might be present in the ambient sir.

After considering factors such as differences in age, susceptibility, possible pre-existing disease and other variables between workers and residents, and based upon an evaluation of all of the scientific evidence, the routine emissions of cadmium from our plant are considered safe for human health, but that more pracise studies of emission rates and possible options for reduction are indicated.

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MONSANTO CONFIDENTIAL

Soda Springs

This information herein is current as of: June 22, 1988

Hydrogen Fluoride

There are no current federal ambient air standards for hydrogen fluoride under the Clean Air Act. The Occupational Safety and Health Administration (OSHA) and the American Conference of Governmental Industrial Hygienists (ACGIH) have each set 3,000 parts of hydrogen fluoride per billion parts of air (3,000 ppb) for protection of workers to prevent primary irritation of the skin, eyes, mucous membranes and the lungs. It also prevents skeletal changes called fluorosis which may be caused by prolonged, excessive exposure to hydrogen fluoride.

Estimated routine plant emissions can be used with computer modeling to calculate an annual average air concentration of hydrogen fluoride for the surrounding community as a whole and for specific geographic locations. These calculations can be used to estimate a hypothetical annual average exposure of the community and a higher maximum annual average concentration for some individuals because of variations in geographic and meteorologic patterns. The model does not precisely predict actual ground level concentrations because of variability in atmospheric conditions. These values are considered conservative, i.e., it has been demonstrated that such predicted air concentrations are higher than actual measured values. Also, continuous annual operation is assumed for these computer estimates. The emission numbers are thus worst case since no plant operation runs continuously over a full year. The emission numbers reported annually under Section 313 will not be

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Hydrogen Fluoride - Soda Springs
Page 2

greater and likely will be less. Nevertheless, these calculated ground level dispersion concentrations can be useful for planning and evaluation purposes.

Computer modeling provides the following information for assessment purposes. The estimated annual average community air concentration resulting from plant emissions is 0.072 parts of hydrogen fluoride per billion parts of air (0.072 ppb). For a simple comparison, the permitted level for exposure of workers is more than 40,000 times higher. Due to geographic and meteorologic variations, the higher annual average air concentration for some individuals could be 9.1 parts per billion parts of air (9.1 ppb). The permitted worker exposure level is over 300 times higher. In both instances, the substantial margins of safety over and above the permitted occupational exposure level and past human experience lead to a conclusion that the routine emissions of hydrogen fluoride will not be irritating.

Since there are differences in the exposure patterns of workers and neighborhood residents, the air concentrations of hydrogen fluoride estimated by computer modeling can be adjusted to allow for these differences. When this is done, the permitted worker exposure is still 8,000 times higher than the estimated annual average community air concentration and over 60 times the annual average air concentration for the most exposed individuals.

HYDROGEN FLUORIDE

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ogen Fluoride - Soda Springs

: 3

Routine plant emissions also can be compared to the amount of pride which could be ingested by drinking water in compliance with Environmental Protection Agency's National Secondary Drinking Water ulations. This drinking water standard would permit the daily intake more than 3,300 times the amount of fluoride that the community might eive from our ambient air emissions and about 25 times the amount the her annual average air concentration individuals might receive. Again, margins of safety are sufficient to prevent the occurrence of fluorosis.

After considering factors such as differences in age, susceptibility, subtle pre-existing disease and other variables between workers and dents, and based upon an evaluation of all of the scientific evidence, e routine emissions of hydrogen fluoride from our plant are within limits fe for human health.

TATE OF IDA

DEPARTMENT OF HEALTH AND WELFARE

DIVISION OF ENVIRONMENT Pocatello

22 Mar 76

MEMO TO: Gordon J. Hopson

FROM

Jim Perry

SUBJECT:

Soda Creek Study and Input from Monsanto Co.

When I arrived Friday, there was a message to call Perry Warner of Monsanto Co. about the Soda Creek Report. Henry said that he had called Bob, and the latest word was not to release reports until we had approval from Boise; so, Henry said he would call Perry to see what he wanted to discuss. He also took the note as a reminder.

Perry, and Kent Lott called at 3:30 P.M., and Henry was not in the office. He had not called them yet either. They had the following comments on the Soda Creek Study:

(Comments refer to Page 10)

Average discharge from Monsanto in August was 6038 cubic meters per day, maximum was 7986.

These are values as cubic meters per day, not per second as reported. The 8052 value was average for July 1975.

The 8052 cms translates to 3.291 cfs; the 7986 cms, translates to 3.26 cfs.

If one then uses these values in the calculation, the resultant K factor becomes 1.055.

The table below then becomes:

Controlled Value	Resultant Maximum
Flow 10,100 M ³ /day (4.13 cfs)	116.2°F
Flow 12,100 M ³ /day (4.95 cfs)	107.6°F
Temperature - 80°F	13.69 cfs
Temperature - 90°F	8.35 cfs

Those values assume a L F increase is the temperature of theather). If the stream classification were not change, and only -0.5% increase allowed, the table would be as follows:

Concrolled Value	Resultan Maximu.
Flow 10,100 M3/day (4.13 cfs)	99.17 F
Flow 12,100 M3/day (4.95 cfs)	92.17 F
Temperature - 80°F	8.7. ofs
Temperature - 90°F	5.84 ofs

It should also be stronged that this is a predictive transfer that has been used to give us a handle on the situation. It definitely needs to be checked empirically before we make any firm use of it.

If further predictions need to be race with the formula, the following relations can be used:

UF = Upstream Flow

F = Cooling Factor (1. 35)

UT = Upstream Temperature

EF = Effluent Flow

ET = Effluent Temperature

Effluent Temperature = $\frac{F[(UF+EF)(DT)] - (UF)(UT)}{EF}$

Effluent flow = $\frac{dF}{ET} \cdot \frac{(F)(DT) - DT}{ET}$

A SURVEY OF WATER QUALITY AND BENTHIC POPULATIONS OF SUDA CREEK. CARIBOU COUNTY, IDARO, AS INFLUENCED BY POINT SOURCE EFFLUENTS

Soda Creek drains a small watershed in Caribou County, Idaho. It has a drainage area of about 46 square miles and an average discharge of 16.8 cfs at 5-mile Headow (about five miles north of Soda Springs). Near the mouth, the discharge is about 52 cfs, with as much as 75% derived from groundwater (Dion, 1969). Hooper Spring, which enters the creek at River Hile 4, is highly mineralized and has a very high CO, content. Honsanto Industrial Chemicals Company has a point source discharge to Soda Creck about one-half mile below Hooper Spring. This effluent is high in phosphorus, nitrate, and sulphate. The effluent also has a high thermal load.

Monsanto has requested that the temperature and flow restrictions be removed from their NPDES discharge permit. They feel their request is justified due to:

- The quality of the water in the creek (1)
- The negligible effect they feel their effluent has on the creek (2)
- The low fish population in the creek

This study was undertaken to measure water quality and benthic populations of Soda Creek and to make recommendations concerning those pormit limitations.

Five stations were chosen on Sods Creek:

- Station 1 is above the confluence with Hooper Spring. It is located near the bridge at the upper edge of Hooper Spring Park.
- Station 2 is located at the bridge that provides access to the power station below Hooper Spring. This is about 0.2 miles below the spring.
- Station 3 consists of Honsanto's effluent to the river, about 0.5 mile below Hooper Spring.
- Station 4 is located about 0.1 mile below Honsanto's confluence with the creek.
- Station 5 is located just upstream from the bridge where U.S. Highway 30 North crosses Soda Creek, outside of Soda Springs. This is about River Hile 1.0.

ter samples were grab samples taken from mid-stream. Benthic pies were taken with a fish net. Samples were taken in April, June, tember, and December, 1975. Fish sampling was done with John Heimer, ik-Pack-Shocker." Idaho Department of Pish and Game, with a 123, 1975.

· Quality:

Mean values for the water quality parameters are listed in Appendix I. ugh Monaanto's affluent is high in several parameters, there does not to be a corresponding increase in those parameters in the creek. Seneral downstream increase in several parameters in the creek. There is point source are as follows:

Spring - increases in nitrate, hardness, conductivity and iron.

ses in ortho-phosphate and zinc. With the latter, this seems to be a

control of precipitation, as pH and alkalinity are both known to affect

lubility of zinc, as are the concentrations of several other metalic

Outfall: An increase in nitrate is apparent. Iron increases, but due to the outfall. Decreases are seen in all three phosphorus is probably due to temperature effects on the equilibria of these

ures of Sods Creek: Monsanto Company took several temperature readings Creek in January. An extensive series of instantaneous readings were June as part of this study. Results of all those measurements are as Appendix 2 (Monsanto) and Appendix 2 (this study). The Monsanto cafilient. There is an increase of 1.50 C to 1.00 C directly in the creek, and 20 C below the effluent in the irrigation canal.

sh were located at Stations 1, 2, or 4. One rainbow trout was ear Station 5, and two more fish (assumedly, rainbow trout) were water. This is not a conclusive population estimate, but is of the fact that this is a harsh environment, with at least a duced fish population. Apparently, at least, some game fish are recebrate Population.

s difficulty was experienced at Station 5, so diversity indices the Upper three stream stations only. The diversity values is ____ons are shown in Appendix 4 in tabular for m. The diversity

indices seem to indicate that Hooper Spring severely affects the benthic populations. These populations then alowly recover downstream from the spring. Honsanto discharges to a pool area above an irrigation dam. It is to be expected that the Soda Creek ecosystem is affected within the area between the dam and outfall. However, the effect does not seem to

Conclusions;

- 1. There is an ecosystem comprised of "other aquatic life" below the Monsanto outfall in Soda Creek. The creek is not "barren" due to water quality or any other consideration.
- 2. The only demonstrable effects of the Monsanto outfall were:
 - A minor increase in nitrate (1)
 - A decrease in phosphorus, both total and dissolved
 - (3) An increase in temperature of 2 degrees centigrade or less directly below the effluent.

Appendix 1. Hean Values of Chemical Parameters from Soda Creek Quarterly Samples.

Ammonia 0.76 0.88 0.77 0.84 0.19 Nitrite 0.004 0.006 0.007 0.007 0.015 Nitrite 0.88 1.33 1.88 2.13 10.4 Nitrate Total Kjeldahl Nitrogen 0.22 0.13 0.07 0.29 11.4 Notrogen 0.22 0.13 0.07 0.29 11.4 Total Inorganic Phosphorus 0.62 0.68 0.35 0.63 17.5 Total Phosphorus 0.21 0.24 0.13 0.22 5.9 Total Phosphorus 239.0 490.5 442.0 495.5 456.0 Total Alkalinity 481.3 487.5 442.5 481.0 350.0 Sulphate 29.0 37.5 32.1 41.9 87.6 Conductivity 760.0 857.5 732.5 822.5 892.5 Chloride 2.0 0.34 0.23 0.34 1.18 Fluoride 2.0 0.34 0.23 0.34 1.18 Fluoride 2.0 0.68 0.88 0.60 0.07 Tron 0.28 0.68 0.88 0.60 0.07 Manganese 72.5 80.0 67.5 87.5 27.5 Manganese 19.3 19.2 18.3 20.5 40.7 Sodium 19.3 8.1 7.6 8.2 12.0 Copper 0.001 0.001 0.001 0.001 Copper 0.003 0.001 0.001 0.001 0.001 Copper 0.003 0.001 0.001 0.001 0.001	Parameter	SC-1 Above Hooper Spring	SC-2 Between Hooper and Monsanto	SC-4 Below Monsanto	SC-5 At Soda Springs	SC-3 Monsanto Effluent
7.inc 0.027 0.005 0.014 0.005 0.500	Anmonia Nitrite Nitrate Total Kieldahl Nitrogen Ortho-Phosphate Total Inorganic Phosphorus Total Phosphorus Total Hardness Total Alkalinity Sulphate Conductivity Fluoride Chloride Iron Manganese Sodium Potassium Copper Lead Selenium	0.004 0.88 1.30 0.22 0.62 0.21 239.0 481.3 29.0 760.0 0.40 2.0 0.28 72.5 19.3 7.7 0.001 0.003 < 0.001	0.006 1.33 1.60 0.13 0.68 0.24 490.5 487.5 37.5 0.34 2.5 0.68 80.0 19.2 8.1 < 0.001 < 0.001	0.007 1.88 1.50 0.07 0.35 0.13 442.0 442.5 32.1 732.5 0.23 2.0 0.88 67.5 18.3 7.6 0.001 (0.001	0.007 2.13 2.25 0.29 0.63 0.22 495.5 481.0 41.9 822.5 0.34 2.0 0.60 87.5 20.5 8.2 0.001	0.015 10.4 1.92 11.4 6-7 17.5 5.9 456.0 350.0 87.6 892.5 1.18 2.25 0.07 27.5 40.7 12.0 0.003 0.001 0.016

Appendix 2. Monsanto Temperature Readings from Soda Creek, Measured in January.

Temperature, OC	Sampling Site
2.8	Above outfall.
2.9	Average of six readings across headgates of the east and west canal below outfall.
3.2	Average of readings on east and west canal, 150 yards below outfall.
3.2 .	At convergence point.
4.0	At next culvert (approximately 1/4 mile).
4.0	At next culvert (approximately 1/4 mile).
2.9	Into Reservoir.

Appendix 3. Temperatures of Soda Creek and the Monsanto Outfall, on June 18, 1975.

Station 1. Above Hooper Spring

Stream 4 meters wide, temperature 11° C on each edge and at each one meter interval across the stream.

Station 2. Between Hooper and Monsanto

Stream 4 meters wide, temperature 11° C on each edge and at each one meter interval across the stream.

Station 3. Honsanto Effluent: 230 C.

Soda Creek at the Monsanto Effluent

Stream 11 meters wide, effluent enters south bank. Heasurements from North to South at one meter intervals.

North	1			4	5 m	6	7 m	8 12	9	10 m	South Bank
Bank 12.j	m 12.5	m 12.5	12.5	12.5	12.5	12.5	12.5	12.5	11.5	12.0	12.5

Soda Creek at the Irrigation Dam, Below the Effluent

The Dam is 14 meters wide. The irrigation diversion leaves the south edge of the dam. Measurements are at one meter intervals across the face of the dam.

North	1	2	3	4	5	6	7	8	9	10	11	12 m	13 12	South Bank
<u>dank</u> 11. 12.	<u>-</u>	12.0	12.0	12.0	12.0	12.5	12.5	12.5	13.0	13.0	13.0	13.5	14.0	14.0

Station 4, Soda Creek about 75 Heters Below the Outfall

Stream is five meters wide. Temperature 12.5 C on each bank and at each meter across the stream.

Sods Creek About 150 Meters Below the Outfall

Stream is eight meters wide. Temperature is 12.0° C on each bank and at each meter across the stream.

Irrigation Canal, About 75 Meters Below the Outfall

Seven meters wide, uniform 13° C.

Appendix 3. (Continued)

Irrigation Canal About 150 Heters Below the Outfall

Six meters wide, uniform 13° C.

Soda Creek at the Confluence of the Irrigation Canal and the Creek.

Three readings: 13° C Average

Soda Creek at the Next Culvert

Three Readings: 12° C Average

Soda Creek at the Next Culvert

Three readings: 12.5° C Average

Station 5, Soda Creek at Highway 91 Bridge

Five Readings: 12.0° C Average

Appendix 4. Benthic Species Diversity

Station	April	June	September	December	Mean
1	1.945	0.293	0.645	1.246	1.032
2	0.712	0.926	0.994	1.210	0.961
3	1.758	1.210	1.024	1.084	1.269
4	N/A	N/A	N/A	N/A	N/A

.ecommendations:

Pour points were raised by Monsanto in their request for a permit modification. This study attempted to find answers to those points, and these recommendations present those findings:

- 1. What should be the boundaries of an equitable mixing zone for the Monsanto outfall in Soda Creek?
- 2. Can stream classification be changed to Class E?
- 3. Is 90° P too hot for an effluent to Soda Creek?
- 4. Can flow be eliminated as a parameter limitation from the Monsanto Permit?

The mixing zone should be defined as follows:

The full width of the stream, from surface to stream bottom, and extending from a point one mater above the Honsanto effluent, exactly to a point of the irrigation dam below the effluent, approximately ten meters downstream. If this recommendation is enacted, this distance should be measured and the exact distance specified in a NPDES Permit revision.

We feel that it is reasonable to reclassify Soda Creek as a Class E stream. The uses to be protected would be:

Domestic Water Supply
Industrial Water Supply
Irrigation
Livestock Watering
Other Fishing and Aquatic Life
Hunting and Wildlife
Aesthetics

In accord with the E Classification, temperature increase of 2° p from that one source (Honsanto) would be allowed. This is in contrast to the 0.5° F increase allowed in a Class A₂ stream.

It should also be specified that the industry will measure stream temperature above and below their mixing zone. The temperature shall be measured with a maximum-minimum recording thermometer, which shall be checked and re-set daily. The temperature shall be measured on a permanent installation within two meters of the upper and lower boundaries of the mixing zone. Temperatures will be measured at the center of the atream. There will be no more than 2° P difference between the two temperature measurements on any given day. Temperature measuring device must be installed within thirty days from the effective of this permit change. The installation will be approved by personnel from Idaho Department of Health and Welfare, Division of Environment, and/or loaho Operations Office of the U.S. Environmental Protection Agency. Weekly averages of the temperature readings will be reported on the Discharge Monitoring Reports submitted quarterly to the EPA and the State.

Using data from the most extreme conditions (August), we have calculated the approximate cooling that is taking place within that designated mixing zone. These calculations are presented in Appendix 4. Using this information, we have estimated the allowable temperature-flow combinations that would not exceed this 2° F increase. Any combination of temperature and flow between these extremes would be acceptable.

If Flow Is:

Temperature Maximum Should Be:

10,100 H³/Day (41.28 cfs) 12,100 H³/Day (49.46 cfs)

83.7° F 81.8° F

If Temperature Is:

Flow Should Be Restricted To:

90° F

(26.83 cfs) 6564 H³/Day

Appendix).

In August, when the creek would be expected to be at extreme conditions, Soda Creek temperatures were as follows:

Above Monsanto	15° c	59° P
Monsanto Effluent	24° C	75.3° F
Helow Proposed Mixing Zone	14 ⁰ د	57.1° P

Plows in Soda Creek at Five-mile Headow average 23 cfs and have minima as low as 12 cfs. Hooper Spring, as well as several other springs, enter Soda Creek above the Monsanto outfall. Dion (1969), reported flows of Soda Creek at the mouth as 52 cfs. Therefore, an estimated flow of 40 cfs in August was used in the following calculations:

The average discharge from the Monsanto plant in August, 1975, was 8052 cubic meters per second (32.91 cfs). This information allows the calculation of a factor which relates the cooling taking place in the mixing zone. This calculation is as follows:

The Resultant Factor is 1.162.

This cooling factor allows a calculation for maximum temperature of a given quantity of discharge or maximum discharge for a given temperature, at test of the calculation, The data for a sample taken in June were entered into the formula and an attempt made to predict downstream temperature if the remaining values were known. The predicted value was 53.9 P and the observed value was 54.3° P. The 0.5° P represents the limits of the test. The following table illustrates limits for the Monsanto effluent:

Controlled Value	Resultant Maximum
Flow - 10,100 H ³ /Day (41.28 cfs) Flow - 12,100 H ³ /Day (49.46 cfs)	83.7° F 81.8° F
Flow - 12,100 H ² /Day (49.46 cfs)	81.8° F
Temperature - 80° P Temperature - 90° P	60.55 cfs
Temperature - 90 P	26.83 cfs
Temperature - 81.8° P	49.38 cfs

The conclusions reached by these calculations are:

Monsanto will probably not violate proposed water quality limits with the present limits on their permit; i.e., 10,100 M /Day and 30 F.

They probably do now (and did on June 18, 1975) violate present water quality limits; i.e., they increase the temperature more than 0.5° F outside their mixing zone boundaries.

If the stream is re-classified to Class E, allowing a temperature increase of 2° F at any time from a single source, an equitable solution will be possible. This will allow a temperature-tlow limit to be placed on the effluent in whatever combination Honsanto feels most comfortable with (as in above table).



SEP 2 5 1951

Reply To Attn Os:

AT-083

NOTICE OF CASE CLOSURE

913-1101.104

Richard Mahoney Chief Executive Officer Monsanto Company Detergents & Phosphates Division P.O. Box 816 Soda Springs, Idaho 83276

Dear Mr. Mahoney:

This concerns the June 18-19, 1991, Environmental Protection Agency (EPA) inspection performed by Gary R. McRae at Monsanto Company's Detergents and Phosphates Division, Soda Springs Plant, Soda Springs, Idaho. The inspection was carried out to determine compliance with the PCB (polychlorinated biphenyl) Regulations adopted by EPA pursuant to the Toxic Substances Control Act (TSCA).

We have now completed a review of Mr. McRae's report on this inspection and are pleased to inform you that no apparent violations of the PCB Regulations were documented.

If you have any questions regarding the inspection or the PCB Regulations, please contact Eileen Hayes-Hileman, EPA Region 10, Pesticides and Toxic Substances Section, Mail Stop AT-083, 1200 Sixth Avenue, Seattle, Washington 98101; telephone (206) 553-2584.

Sincerely,

Gil Haselberger, Chief Toxic Substances Section

cc: Donald R. Wind, Environmental Specialist, Monsanto Company

bcc: List I - KVL

R. L. Geddes

D. P. Beauregard

J. P. Hyland - G4WT

P. H. Smith - E2NK

V. T. Matteucci - G5NR

G. W. Mappes - A2NE

Env. Contact File No. 857

(File: PCB's)

FYI.

· mill Bilarmin Truriculum moto (G.24-91 10:44.81) SENT BY: Xerox Telecopier 7020 : 8-24-91 :10:29AM ;

2008011964;# 1 2068811984:# 1

913-1101.104

MONSANTO COMPANY P.O. BOX 816, HWY 34 NORTH, SODA SPRINGS, IDAHO 83276 (208) 547-3391

****FAX COYER SHEET****

FAX TEL.# (208) 547-3312

THERE ARE PAGE(S) PLUS COVER SHEET DATE 9/24/1991
TO: Bill Wright FAX TEL. # 206 - 881 - 1984
FROM: ORIGINATOR'S NAME B. Geodles
MESSAGE: Bill - Don Wind is out this week. I put this together and with have Don finalize and add any
together and will have Don finalize and add any
additional it necessary.
<u>. </u>
- Streets.

NOTE: IF QUALITY OF MESSAGE IS POOR, OR IF RECEIVED INCOMPLETE, PLEASE CALL ORIGINATOR.

PCB AND TRANSFORMER HISTORY AT THE SODA SPRINGS PLANT

Because of the nature of the operation at Monsanto's Soda Springs plant and the high process demand for electricity, transformers and other electrical equipment containing insulating fluids have been used extensively. A complete file dating back to 1978 is maintained at the facility. This file includes a history of service, inspections, fluid characteristics, and the retirement of fluids and transformers.

Efforts have progressed over the last several years to become PCB free by initiating a comprehensive sampling program and replacing contaminated equipment. As transformer fluids were found to contain regulated levels of PCB's, accepted methods of treatment or off-site incineration were contracted to reputable companies who specialize in PCB/transformer management.

As part of the plants Oil Spill Prevention, Control and Countermeasure Plan (SPCC) an addendum has been included to cover the storage facility for polychlorinated biphenyls (PCBs) and PCB items identified for disposal. A specific, secured location within the plant boundary has been assigned for temporary storage for PCB items until proper disposal arrangements can be made. An inspection interval has also been designated to ensure that these materials are not leaking and that timely disposal is accomplished. A copy of Addendum A to the SPCC plan is attached.

During the summer of 1991, Mr. Cary McRae, EPA Environmental Specialist, from the Region 10 Boise office, completed a PCB inspection at the facility. All records from the past five years were inspected and found to be in order. A final report is expected to be issued no later than December, 1991.

As part of the RI/FS Workplan a complete review of the PCB file will be completed and summarized. The information reviewed will be compared to the historical information available, relating to PCE's and electrical equipment used at the site. Information gathered from this exercise will be compared to the groundwater analysis designed to identify any inorganic compounds (see section ____). Based upon what is learned by combining and comparing these two exercises, decisions can be made regarding the need for any additional effort to define this potential pathway.

ADDENDUM A

OIL SPILL PREVENTION, CONTROL AND COUNTERMEASURE PLAN

STORAGE FACILITY FOR POLYCHLORINATED BIPHENYLS (PCBs) and ---

PCB ITEMS DESIGNATED FOR DISPOSAL

A. PCB STORAGE FACILITY

1. Location:

The facility is located in the northwest corner of the Ore Building on the ground floor, in a room formerly known as the XEG room.

2. <u>Description</u>.

The facility is constructed of cinder block with a concrete floor and B inch continuous concrete curbing. The 24 by 18 foot facility provides storage capacity for up to fifty 55-gallon barrels of PCB material.

B. STORAGE REQUIREMENTS

- Any container used for the storage of liquid PCBs shall comply with the shipping container specification of the Department of Transportation (DOT), 49 CFR 178.80 (Specification 5B, Without Removable Head), 178.102 [Specification 6D, Overpack with Specification 2S (178.35) or 2SL (178.35a) Polyethylene Containers)] or 178.116 (Specification 17E, Container).
- Any container used for the storage of non-liquid PCBs shall comply with the specifications of 49 CFR 178.80 (Specification 5, Container), 178.82 (Specification 5B, Container), or 178.115 (Specification 17C, Container)
- 3. PCB articles and PCB containers shall show on the article or container the date they are placed in storage. Furthermore, a record shall be kept of any batch of PCBs removed from the container, including date, quantity, and disposition.
- 4. Temporary storage (storage outside of the approved facility for a maximum of 30 days) of liquid exceeding 500 parts per million (ppm) PCBs is prohibited. Each container or article in the temporary storage must bear a notation that indicates that the liquids in the drum do not exceed 500 ppm PCB.
- 5. No item of movable equipment that is used for handling PCBs and the Pitems in storage facilities and that comes in direct contact with PCBs shall be removed from the storage facility area unless it has been decontaminated as specified in Annex IV. of 40 CFR, Part 761.79.

C. SPILL PREVENTION

All PCB containers and articles shall be checked for leaks at intervals of not more than 30 days.

D. CORRECTIVE ACTION IN THE EVENT OF PCB LEAKAGE

- 1. Transfer leaking containers and articles, and their contents, to properly marked non-leaking containers (as per the above mentioned DOT specifications).
- 2. Use sorbents to clean up any spilled or leaked material immediately. This material is located in a small storage room next to the PCB storage facility.
- 3. Dispose of all PCB contaminated material in an approved manner or return it to storage.

E. SECURITY

- The facility is located within the fenced plant site and the entrance gate has a guard.
- . 2. Entry to the storage facility will be restricted to authorized personnel.

F. DESIGNATED PERSON IN CHARGE OF PCB STORAGE/DISPOSAL AND RECORD KEEPING AT THIS PLANT

D. R. Wind, Senior Environmental Engineer

G. MANAGEMENT APPROVAL

This addendum will be implemented as herein described.

C. M. McCullough, Plant Manager

H. CERTIFICATION

I hereby certify that I examined the facility and, being familiar with the provisions of 40 CFR, Part 112 and 40 CFR, Part 761, attest that this addendum has been prepared in accordance with good engineering practices.

P. C. Kowallis, P.E. Idaho Certificate 4363

2085473312→

2065811984;# 1

Total Quality

Monsanto

LOCATION-PHONE)

R.L. Geddes - Soda Springs - Ext. 234

DATE

March 20, 1992

BUBJECT

Raw Material Analysis

REFERENCE

RI Report

TO

Cindy Yates, Golder Associates

The following is analytical information on the raw materials used in the Monsanto - Soda Springs process.

If you need of more information, let me know.

Post-It brand fax transmitta	memo 7671 + of pages >
to Cindy Yates	From R.L. Geddes
Go. Golder Assoc.	Monsand
	Phone #
ax# 206 - 882 - 5498	Fex # 2-06 Sx7- 33/2

Chen-Northern, Inc.

3/29 COMPOSITE DELIVERED SWEETHATER COKE ANALYSIS CHEMICAL CONSTITUENTS MONSANTO, INC.

April 10, 1989 Job No. 79-920-1 Sheet 4 of 11

ullant in

• 40

TEST RESULTS:

Billiann na Ri.

11 22

IESI KESOLIS.				
Lab No.: Sample Description: Date Sampled:	96190 3A None Given	96191 3B None Given	96192 3C None Given	Date —
Collected by:	Monsanto	Monsanto	Monsanto	Analyzed ×
Total Metals. mg/kg Antimony as Sb Arsenic as As Barium as Ba Beryllium as Be Cadmium as Cd Chromium as Cr Cobalt as Co Copper as Cu Iron as Fe Lead as Pb Manganese as Mn Mercury as Hg Molybdenum as Mo Nickel as Ni Selenium as Se Silver as Ag Vanadium as V Zinc as Zn Calcium as Ca Magnesium as Mg	Monsanto 40 <22 <600 <33 <30 60 4130 <10 <10 <10 <10 <10 <10 <10 <10 <10 <600 <10 <10 <10 <10 <10 <10 <10 <10 <10 <	30 <2 <50 <2 <2 10 20 60 4400 <9 <9 <0.2 <20 9 <20 <9 <9 <90 <9 2800 <500	<pre></pre>	3/29/89 .00003 4/05/89 3/29/89 3/29/89 3/29/89 .00006 3/29/89 .00006 3/29/89 .00006 3/29/89 .00005 3/29/89 .00005 3/29/89 .00005 3/29/89 .0000 3/29/89 .0000 3/29/89 .0000 3/29/89 .0000 3/29/89 .0000 3/29/89 .0000 3/29/89 .0000 3/29/89 .0000
Sodium as Na	3200	1900	1700	4/03/8923
Potassium as K	<220	<240	<280	4/04/89 .002
Fluoride as F, mg/kg	8.8	5.1	4.3	3/28/89 . 200006
Total Phosphorus as P, mg/kg	1100	660	490	4/04/89 .0007
Thorium as The pullyrams	+56 r 203	103-52	32.1 = 17.9	None given Oola
Thailium as TI,	<60	<5 0	<60	4/14/89 .0000

1.11

Client Name:

MONSANTO, INC.

Job Number: Project Name:

79-920

Soda Springs Plant Process Streams

March 7, 1991 Sheet 4 of 10

Laboratory No.: Sample Name:

112455 3A Enoch Valley Ore: 7/90 to

112462 3B Enoch Valley Ore: 7/90 to

9/90

112469 3C Enoch Valley Ore: 7/90 to 9/90

Sample Date: Collected by: Time Sampled:

9/90 02/18/91 Donald R. Wind 0945

02/18/91 Donald R. Wind 0945

02/18/91 Donald R. Wind 0945

> 15,100 58,200

All in mg/kg

INORGANICS

Fluoride	17,700	16,500
Total Phosphorous	-196,000	- 96,000
METALS		
Aluminum Total Antimony Total Arsenic Total Barium Total Beryllium Total Cadmium Total Calcium Total Chromium Total Cobalt Total Copper Total Iron Total Lead Total Magnesium Total Manganese Total Mercury Total Molybdenum Total Nickel Total Potassium Total Silicon Total Silicon Total Silver Total Total Thallium Total Thorium Total	11,000	13,000 <49 10 94 45 140 260,000 910 <24 120 8000 <24 1400 82 0.4 <24 71 3900 <1.4 49,000 14 3700 <66 *
Vanadium Total	1200	1200
Zinc Total	750	800

1200

680 .0007

^{11,000} <46 .00005 12 .00001 93 .0001 44 . 00005 130 ,0001 290,000 760 .000? <23 .0000; 100 .000! 8200 (23 .0000) 1400 . 2014 93 .0000 0.5 4×10-7 <23 .00002 58 .00006 3700 <1.4 .00000 87,000 14 .00001 3600 16000. 6>

^{*} To be reported upon completion

MONSANTO COMPANY SODA SPRINGS, IDAHO

SILICA SAND - XRF POWDER ANALYSIS

	AS - IS	UPGRADED
• SiO2	99.27%	99.74%
· Fe203	0.073	< 0.010
- Al203	0.370	0.090
- P205	<0.050	< 0.050
° S	<0.050	< 0.050
CI	<0.020	< 0.020
· Na20	<0.050	< 0.050
⁻ MgO	0.100	<0.050
∘ K20	0.070	0.030
· CaO	0.020	< 0.010
- TiO2	<0.010	<0.010
₁ MnO	<0.010	<0.010
BaO	<0.010	< 0.010
, V	13 ppm	<10 ppm
« Cr	27	24
Ni	<10	<10
Cu	<10	<10
Zn	<10	<10
As C::	<20	<20
\$n	< 50	< 5 0
Pb Mo	<10	<10
Sr	<10 <10	<10
U	<10	<10 <10
Th	<10	<10
NÞ	<10	<10
Zr	35	29
Rb	<10	<10
Y	<10	<10

Golder Associates Inc.

4104-148th Avenue, NE Redmond, WA 98052 Telephone (206) 883-0777 Fax (206) 882-5498



November 23, 1994

Our ref: 913-1101.607

U.S. EPA Region X 1200 Sixth Avenue Seattle, WA 98101

ATTENTION: Mr. T. Brincefield

RE: CORRECTION FACTOR FOR GEIGER-MUELLER MEASUREMENTS

Dear Mr. Brincefield:

Appendix F of the recently submitted "Baseline Risk Assessment for the Monsanto Company Soda Springs Site: On-Site Occupational Scenario (Abridged)" prepared by Montgomery Watson, dated November 16, 1994 included a discussion of the need to correct gamma radiation measurements from a Geiger-Mueller detector to tissue-equivalent readings. However, the relevant equation was not included in the Appendix. The gamma radiation measurements collected by Golder Associates with the Geiger-Mueller detector should be transferred to tissue-equivalent readings with the following approximation:

$$PIC = a + b M_{19}$$

where

a = cosmic exposure rate

b = 0.5

 M_{19} = meter reading

This relationship was provided by J. Alvarez of IT Corporation (personal communication November 18, 1994) and should be considered approximate since measurements with both a PIC (pressurized ionization chamber) and Model 19 are not available at the same location for calibration purposes.

If you have any questions, please contact Bill Wright at Montgomery Watson or myself.

Sincerely,

GOLDER ASSOCIATES INC.

David Banton
Associate

DB/ca

cc:

R. Geddes, Monsanto

D. Wilson, Monsanto

W. Wright, Montgomery Watson

J. Alvarez, IT

A. Hafferty, E&E

G. Brown, IDEQ

1123dab1.h3

Golder Associates Inc.

4104-148th Avenue, NE Reamond, WA 98052 Telephone (206) 883-0777 Fax (206) 882-5498



February 23, 1994

Our ref: 913-1101.604

United States Environmental Protection Agency Region X 1200 Sixth Avenue, HW-113 Seattle, Washington 98101

ATTENTION: Mr. Tim Brincefield

RE:

REGRESSION OF SOLUBLE FLUORIDE VERSUS TOTAL FLUORIDE

IN OFFSITE SOILS AT MONSANTO

Dear Tim:

Attached are several tables and a figure that show the results of a linear regression analysis conducted by Golder Associates Inc. for soluble and total fluoride analyses from selected offsite soils near the Monsanto Plant in Soda Springs, Idaho.

Table 1 provides the analytical results together with the loge transformation. The data were transformed to allow the use of linear regression for data that appeared to be described by a nonlinear relationship (data not shown) and to ensure variance homogeneity. Table 2 shows results of the linear regression analysis. This analysis shows an r²=0.609. The analysis of variance (Table 2) shows this is a significant regression and the regression coefficients are significantly different than zero (p<0.005). Figure 1 shows the relationship between the measured total fluoride and the predicted total fluoride using the linear regression equation developed in this analysis:

 log_e (Total Fluoride) = 5.440 + 0.8672 log_e (Soluble Fluoride)

Based on this analysis, we feel that the soluble fluoride data are adequate to predict total fluoride concentrations in the offsite soils surrounding the Monsanto Soda Springs Plant. The predicted total fluoride data would be suitable for use in a risk assessment if this is necessary.

If you have any questions about this analysis please give us a call.

Sincerely,

GOLDER ASSOCIATES INC.

Craig Hunter Project Scientist

David Bantor

Associate

CH\DB\ln

Attachment

cc: R. Geddes, Monsanto

D. Wilson, Monsanto

J. Eldridge, SAIC Project Files

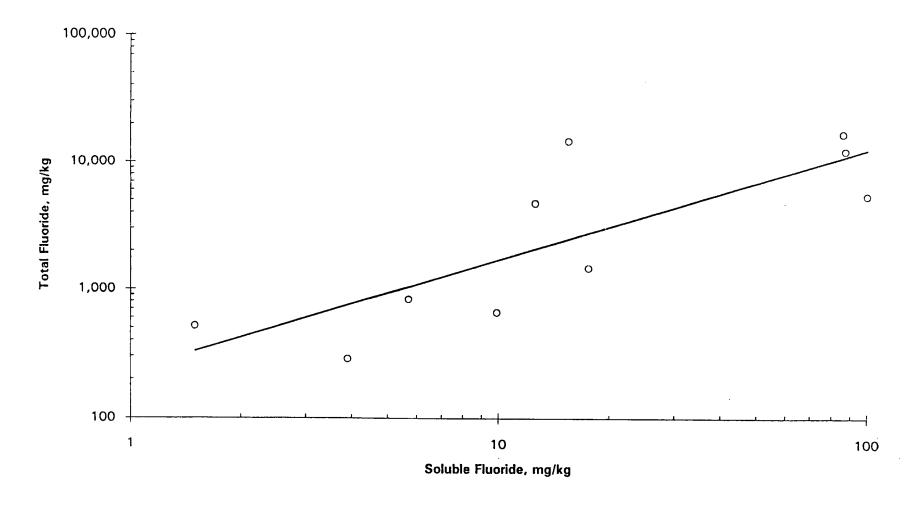
TABLE 1

COMPARISON OF SOLUBLE AND TOTAL FLUORIDE ANALYSES

Sample mg/kg	Soluble Fluoride	log _e (Sol F)	Total Fluoride mg/kg	log _e (Tot F)
Back-1	3.9	1.361	286	5.656
Back-2	1.5	0.405	518	6.250
Back-3	5.7	1.740	832	6.724
MS2-11	17.6	2.868	1,470	7.293
MS2-13	9.9	2.293	662	6.495
MS2-7	100.0	4.605	5,400	8. 594
S-01	12.6	2.534	4,740	8. 464
S-09	15.5	2.741	14,700	9.596
S-13	85.9	4.453	16,800	9.729
S-13d	87.0	4.466	12,300	9.417

Multiple R R Square Adjusted R Square Standard Error	0.807794 0.652532 0.609098 0.949225					
Observations	10					
Analysis of Variance						
	dſ	Sum of Squares	Mean Square	F	Significance F	
Regression	1	13.53675088	13.5367509	15.02367	0.00470103	
Residual	8	7.20822394	0.90102799			
Total	9	20.74497483				
	Coefficients	Standard Error	t Statistic	P-value	Lower 95%	Upper 95%
Intercept	5.440081	0.68387348	7.95480683	2.32E-05	3.86306534	7.017098
x1	0.867152	0.223721093	3.87603845	0.003754	0.35124946	1.383054





LINEAR REGRESSION OF TOTAL VERSUS SOLUBLE FLUORIDE FOR SELECTED MONSANTO OFF-SITE SOILS MONSANTO/SOIL INVESTIGATION/ID

PROJECT NO. 913-11

DRAWING NO. 49068 DATE 2/23/94 DRAWN BY TK

Golder As iates

MEMORANDUM

TO: Monsanto Soda Springs Plant Phase I RI File

November 12, 1991

FR: Bill Wright

RE: DOCUMENTATION OF ECOLOGICAL DATA COMPILATION, PHASE I RI

ACTIVITY 6a (913-1101.206)

During the week of November 4, 1991, Bob Geddes and I visited several local, regional, and state officials to compile a wide variety of available ecological data pertinent to the Soda Springs Plant RI/FS. The following agency representatives were interviewed:

Monday, November 4:

Clayton Schmitt — City Administrator, City of Soda Springs

Kirk Hansen — Mayor, City of Soda Springs

Robert Anderson — Commissioner, Caribou County

Tuesday, November 5:

• Ray Nelson - Chairman, Caribou County Planning and Zoning Commission

Bob Kukachka — Soil Survey Project Leader, U.S. Department of Agriculture,
 Soil Conservation Service

Thomas Hepworth — Environmental Health Specialist, Southeastern Idaho
 District Health Department

 Tony Varilone — District Ranger, Caribou National Forest, Soda Springs Ranger Station

 Carl Anderson — Regional Wildlife Biologist, Idaho Department of FIsh and Game

Jim Mende — Regional Fishery Biologist, Idaho Department of Fish and Game

 Wallace Evans — Area Manager, U.S. Department of the Interior, Bureau of Land Management, Idaho Falls District, Pocatello Resource Area

 Jeff Cundick — Mining Engineer, U.S. Department of the Interior, Bureau of Land Management, Idaho Falls District, Pocatello Resource Area

Wednesday, November 6:

 Dennis Dunn — Senior Water Resource Agent, Idaho Department of Water Resources, Idaho Falls Regional Office

 Boyd Roberts — Superfund Project Coordinator, Idaho Department of Health and Welfare, Division of Environmental Quality, Pocatello Regional Office

Thursday, November 7:

• Water Well File - Idaho Department of Water Resources, Headquarters

 Joe Nagel — Director, Idaho Department of Health and Welfare, Division of Environmental Quality, Headquarters Lance Nielsen — Remedial Activities Section Manager, Idaho Department of Health and Welfare, Division of Environmental Quality, Headquarters

Chuck Lobdell - Field Supervisor, U.S. Department of the Interior, Fish and

Wildlife Service, Idaho Field Office

Robert Parenti, Ph.D. — Botanist/Ecologist and Tri-State Plant Program
 Manager, U.S. Department of the Interior, Fish and Wildlife Service, Idaho Field
 Office

The results of each interview conducted is provided in a separate attachment to this memorandum. No one was interviewed at the Boise office of the Idaho Department of Water Resources; we merely conducted a file search. The officials of the Division of Environmental Quality were also not interviewed; the visits in these cases were merely courtesy calls.

Attachments

Clayton Schmitt City Administrator

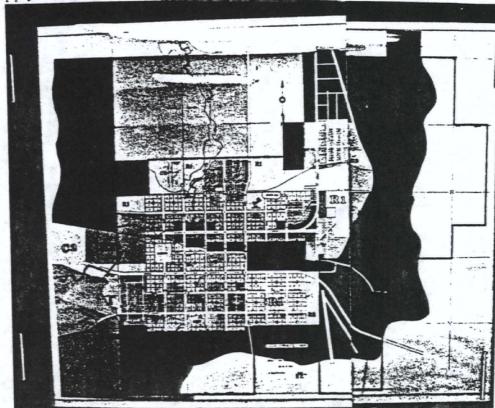
Position: Affiliation:

City of Soda Springs, Idaho

Date:

November 4, 1991

- Mr. Schmitt presented us with a copy of the city's zoning ordinance (Title 17);
 he indicated that the Caribou County, Grace, and Soda Springs Comprehensive
 Land Use and Water Quality Plan, dated 1977, is still in effect (see the
 accompanying photograph for zoning updates within the city).
- Over the past 10 yr, the city's population has declined by approximately 1,000
 (the 1980 census was ~ 4,100; the 1990 census ~ 3,100); Mr. Schmitt sees a stable
 city population, with no significant growth, for the foreseeable future; all
 industries in the city are currently operating at capacity.
- Approximately 60% of the industrial employees in the area live outside of the
 city; existing subdivisions within the city contain approximately 200 easily
 developable lots (i.e., water and power are already available), and there are
 about 130 vacant mobile home lots; as new homes are being built at a rate of
 about 5/yr, the city anticipates no need to develop non-platted areas.
- The city has no direct interest in the Monsanto property; potential development opportunities for the Plant property (although such action is unlikely) were discussed during the interview and Mr. Schmitt came up with the following concepts industrial development (utilization of existing rail siding and other infrastructure in place), recreational development (regarded as desireable); however, Mr. Schmitt stated that if Monsanto were ever to leave Soda Springs, he estimates the city would become an agricultural and ranching supply community of about only 1,200 residents.



Kirk Hansen

Position:

Mayor

Affiliation:

City of Soda Springs, Idaho

Date:

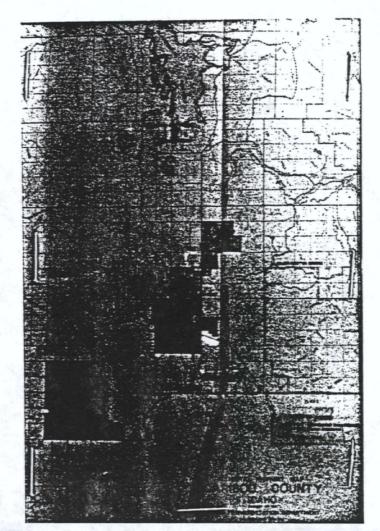
November 4, 1991

- Mayor Hansen believes there is no general community concern about the Monsanto Plant.
- The Mayor foresees the city population to be stable or to grow slightly in the future.
- The Mayor foresees no future city use of the Monsanto Plant property.
- The Mayor expressed concern over EPA's unwillingness to listen to local citizens in regard to environmental issues.

Position: Affiliation: Robert Anderson County Commissioner Caribou County, Idaho November 4, 1991

Date:

- Commissioner Anderson's only environmental concern regarding the Monsanto Plant is that it sits astride a seasonal deer migration route. A winter range is located along Soda Creek; however, he acknowledged that the deer are now adapted to the presence of the Plant and migrations are not disrupted.
- The Commissioner estimates the county's population to be stable, or to be subject to only very modest growth, over the foreseeable future.
- We discussed land use in the vicinity of the Plant (see accompanying photograph of county land use plan). There is an impact area encompassing the City of Soda Springs within which the city retains land use authority. The area around the Plant and to the northeast of the Plant is zoned for heavy industrial use.
- The Commissioner stated that the county has no desire or expectation of
 establishing any other land use, other than heavy industrial, in the Plant
 vicinity. He also sees no changes in uses of surface or ground waters in the
 project area.



Ray Nelson

Position:

Chairman

Affiliation:

Caribou County, Idaho, Planning and Zoning Committee

Date:

November 5, 1991

Interview Summary:

• Chairman Nelson projects only slight growth for the county in the foreseeable future.

- The city's zoning jurisdiction extends 1 mi past the city limits in all directions (Chairman Nelson provided us a copy of the current zoning ordinance [#83-1]).
- With respect to the residential potential of the agricultural land in the vicinity
 of the Monsanto Plant, Chairman Nelson indicated that up to 1 home/40 ac is
 allowed; any higher density requires formal subdivision of the property.

Bob Kukachka

Position:

Soil Survey Project Leader

Affiliation:

U.S. Soil Conservation Service — Soda Springs

Date:

November 5, 1991

- Mr. Kukachka is not aware of any soil or agricultural impacts attributable to the Monsanto Plant. (This statement was qualified by the fact that neither he nor his department has jurisdiction or expertise on this issue.)
- Mr. Kukachka has reviewed aerial photographs of the Soda Springs area dating from 1941 to present. He indicated that these photographs show no indication of vegetation impacts in the vicinity of the Plant. (These photographs are available for review at the local SCS office.)
- Mr. Kukachka indicated that climatological data can be accessed from his office through a computerized database. He indicated that the average annual precipitation at the Soda Springs airport is a bit over 17 in; he also provided a copy of frost data obtained from the airport.

Thomas Hepworth

Position:

Environmental Health Specialist

Affiliation:

Southeastern Idaho District Health Department — Soda Springs

Date:

November 5, 1991

- Mr. Hepworth was not aware of any health problems associated with the Monsanto Plant; he has also not discerned any concerns on the part of the public in relation to the Plant.
- Mr. Hepworth stated his belief that Monsanto has done everything possible to comply with environmental regulations.
- Mr. Hepworth would like to see Monsanto and EPA cooperate better in the community relations process to avoid unnecessary public confusion and alarm.

Tony Varilone

Position:

District Ranger

Affiliation:

U.S. Forest Service, Caribou National Forest, Soda Springs Ranger

Date:

November 5, 1991

Interview Summary:

Mr. Varilone believes that the Monsanto Plant has absolutely no impact on local national forest lands; he regards Monsanto as a leading industry in terms of environmental control.

Mr. Varilone stated that the following endangered, threatened, or sensitive species exist in the region, but any critical or sensitive habitats are located beyond 30 to 40 mi from the Plant and none of these species frequent the Plant vicinity - whooping crane, peregrine falcon, sensitive trout species (not in Bear R. drainage, however), bald eagles.

Carl Anderson/Jim Mende

Positions: Affiliation: Regional Wildlife Biologist/Regional Fishery Biologist Idaho Department of Fish and Game — Pocatello

Date:

November 5, 1991

- Concern was expressed about the potential for waterfowl use of ponds on the Plant site (Bob Geddes indicated that waterfowl do use the non-contact cooling water and sewage ponds, but has never seen any use of the phossy water pond); effects of waterfowl exposure to the contaminants in these ponds was identified as the greatest concern from the terrestrial perspective.
- From an aquatic perspective, the greatest concern identified was to assess the potential impacts to Alexander Reservoir and, especially, that portion of the Bear River immediately downstream of the reservoir (the state is attempting to establish a reasonable fishery in the portion of the river); the state may take steps at some point to attempt to establish a fishery in Soda Creek (hatchery salmonids have survived for 20 to 30 d in Soda Reservoir); non-routine releases of contaminants (i.e., spills) were perceived to have the greatest potential impact on the aquatic environments of interest.
- Potential species of concern in the project region were identified as trumpeter swans, bald eagles, and whooping cranes; Mr. Anderson indicated that the whooping cranes are unlikely transients and that no critical habitats for any of these species are known to exist in the vicinity of the Plant.

Wallace Evans/Jeff Cundick

Positions:

Area Manager/Mining Engineer

Affiliation:

U.S. Bureau of Land Management, Idaho Falls District, Pocatello

Resource Area

Date:

November 5, 1991

- BLM owns land in the Formation Spring watershed; a phosphorus prospecting
 permit was filed with the agency some time ago, but never pursued by the
 interested party (at the time it was filed, the City of Soda Springs expressed
 concern about potential impacts to the municipal water supply).
- The Nature Conservancy has purchased property near the above-mentioned BLM land and is proposing the creation of a preserve encompassing both land parcels.
- No endangered or threatened species are known to occur on or near the above-mentioned BLM property; some moose and deer use the land; streams on the property are devoid of fish, but ponds on the Nature Conservancy land have non-spawning populations of fish.

Dennis Dunn

Position:

Senior Water Resource Agent

Affiliation:

Idaho Department of Water Resources, Idaho Falls Regional Office

Date:

November 6, 1991

- Mr. Dunn provided copies of all well logs for R.41E and R.42E T.7S, T.8S, and T.9S; he believes the files are incomplete for the period prior to 1987 (the files of the Boise office were searched, on November 7, for these same townships and found to be more extensive).
- Mr. Dunn recommended having a local driller review the well location map prepared for the RI report to see if any other active well locations are known to exist.
- Because of the incompleteness of the well records, Mr. Dunn also recommended conducting a door-to-door well survey in the downgradient direction from the Monsanto Plant.

Chuck Lobdell/Bob Parenti, Ph.D.

Positions:

Field Supervisor/Botanist, Ecologist, and Tri-State Plant Program

Manager

Affiliation:

U.S. Fish and Wildlife Service, Idaho Field Office

Date:

November 7, 1991

- Mr. Lobdell requested that we submit a written request for an endangered and threatened species review of the project site (project location and vicinity map required with the written request); USFWS will then access the Idaho Natural Heritage Program database for this information, which will also supply information on any sensitive species in the vicinity of the Monsanto Plant; USFWS will take species mobility into account during the data search.
- Mr. Lobdell suggested updating the above-mentioned information request periodically during the course of the project (e.g., every 6 mo).
- Mr. Lobdell and Dr. Parenti indicated that no ecological risks from the Plant are anticipated, and that their philosophy is that if protection of human health is ensured in accordance to CERCLA requirements, environmental protection will generally also be ensured.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Boise Field Station 4696 Overland Road, Room 576 Boise, Idaho 83705 Golder Associates

December 2, 1991

Golder Associates

William E. Wright Senior Environmental Scientist Golder Associates, Inc. 4104 148th Avenue NE Redmond, Washington 98052

Re: Request for a Natural Heritage Program Database Review 913-1101.206 (1019.1032) 1-4-92-SP-95

Dear Mr. Wright:

The information you requested regarding listed and proposed endangered and threatened species in the vicinity of the Monsanto Soda Springs Plant is enclosed. In addition to these species, the Conservation Data Center (formerly Heritage Program) listed a willow (Salix candida), which occurs along Ledger Creek east of the Plant (T9S, R42E, S5), as Bureau of Land Management and U.S. Forest Service "sensitive".

The U.S. Fish and Wildlife Service (Service) and other Department of Interior agencies submitted a Preliminary Natural Resources Survey on the Monsanto Site to the Environmental Protection Agency in June, 1991. In that document, the Service identified important trust resources and potential contaminant pathways to be considered in any future remedial investigations.

Testing of surface water samples by Ecology and Environment (Ecology and Environment, Inc. 1988. Site Inspection Report for Monsanto Chemical Company, Soda Springs, Idaho. TDD F10-8702-06. 29 pp.) revealed elevated concentrations of selenium, vanadium, and zinc at Mormon Springs, which surfaces near the southwest corner of the Monsanto Site and flows into Soda Creek and ultimately Alexander Reservoir. The effluent discharge water, which flows offsite near the southwest corner of the site and also enters Soda Creek, contains elevated concentrations of aluminum, cadmium, iron, selenium and vanadium.

Significant fish and wildlife habitats located near the Monsanto Site include the Bear River and Alexander Reservoir, located about 2.5 miles southwest of the Site, and Formation Springs, a property owned by the Nature Conservancy located about 1.5 miles northeast of the Site. Grays Lake National Wildlife Refuge is located about 25 miles north of the site.

Key trustee species which inhabit the Bear River/Alexander Reservoir area include bald eagles, white pelicans, Canada geese, and several species of ducks and shorebirds. About 10-12 bald eagles (endangered) winter in the Bear River/Alexander Reservoir area from Soda Springs downstream about 5 miles to Soda Point. White pelicans forage in Alexander Reservoir in the summer, and numerous shorebirds feed on the mudflats of Alexander Reservoir during late summer. Canada geese are found in the area all year, and nest along the Bear River and Alexander Reservoir. Several species of ducks utilize the area during spring and fall migration (Carl Anderson, Idaho Department of Fish and Game, personal communication).

Alexander Reservoir, operated by Utah Power and Light, provides a marginal rainbow trout and yellow perch fishery. It was completely drawn down the past two winters for maintenance work at the dam. The Bear River below the Reservoir supports a fair rainbow trout fishery. Smallmouth bass have also been introduced into this reach (Jim Mende, Idaho Department of Fish and Game, personal communication).

The Service is not aware of any biological sampling that has been done in the vicinity of the Monsanto Site, including the affected spring discharges, Soda Creek, Alexander Reservoir or the Bear River below Alexander Reservoir. appears to be a strong possibility that plant and/or animal species could be affected by the elevated concentrations of aluminum, cadmium, selenium, vanadium, zinc or other chemical constituents that have been detected in Mormon Springs and the effluent discharge stream, both of which discharge into Soda Creek and eventually Alexander Reservoir. Also, several analytes, including vanadium, were detected in groundwater samples taken from the Kerr-McGee Site (Ecology and Environment, Inc., 1988. Final Site Inspection Report for Kerr-McGee Chemical Corporation, Soda Springs, Idaho. TDD F10-8702-04. 50 There is some indication this contaminated groundwater may also be contributing to contaminants detected in groundwater and spring water samples taken from the Monsanto Site. Such sampling of biological matrices is necessary to determine if harmful concentrations of these chemical constituents are accumulating in biological systems at potentially harmful levels. Any biological sampling should be designed to address potential contaminants from both the Monsanto Chemical Company and Kerr-McGee Sites since it appears both sites may be contributing contaminants via spring discharge near Soda Creek.

The potential for impacts to trustee resources of the Service from air emissions were not addressed in the Final Site Inspection Report . However, this potential pathway should be addressed since air pollution from the facility frequently drifts over habitats occupied by trustee resources.

In conclusion, information presented in the Ecology and Environment Final Site Inspection Report indicate the probable release of several toxic inorganic constituents into springs which discharge into Soda Creek and ultimately Alexander Reservoir on the Bear River. Such discharges may be impacting natural resources under the trusteeship of the Service, including migratory waterfowl, other migratory birds and endangered species. Sampling of biological resources, including food chain items, is recommended to determine if potential pathways exist between observed discharges of contaminated groundwater and resources under the trusteeship of the Service.

We appreciate the opportunity to discuss the ecological aspects of the remedial investigation you are undertaking for the Monsanto Soda Springs Plant. Please contact Bill Mullins (208/334-1931) of my staff if you have any questions regarding these comments.

for Charles H. Lobdell
Field Supervisor

Enclosures

AS REQUESTED LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, AND CANDIDATE SPECIES, THAT OCCUR NEAR THE CITY OF SODA SPRINGS

DATE: December 2, 1991

PROJECT NAME: Monsanto Soda Springs Plant

SPECIES LIST NO. FWS 1-4-92-SP-95

LISTED SPECIES

COMMENTS

Bald Eagle (Haliaeetus leucocephalus)

Wintering Area

PROPOSED SPECIES

None

CANDIDATE SPECIES

None

OTHER SPECIES

Hoary Willow (Salix candida)

BLM & FS Sensitive Species



FROM Soda Springs --LOCATION-PHONE)

: February 4, 1992

CC:

713-1101.207

: Additional Data Needs SUBJECT

: Soda Springs NPL RI/FS Report : Rick Kossik, Golder Associates TO

Rick, I have finally been able to get some of the information that you requested.

Well Data

- I was not able to get water levels at either the Harris or theLewis (Delvin Humble) well. There is physically no way to get the measurement unless we dismantle the well head assemble. Delvin Humble told be that he has tried to do that in the past and he was unable to remove the cap. The Harris well has no sampling port.
- TW 2 This well pumps at approximately 10 gpm. It is used only periodically for the operation of the electrode seal water pond. I measured the water level on 1/31/92. The pump was not operating at the time the measurement was taken. The depth to water was 56.52 feet. The measuring point is the same elevation as was surveyed.
 - TW 40 Test Well 40 was measured on 2/4/92 at 88.72 feet.
 - TW 48 Test Well 48 was measured on 1/31/92 at 63.64 feet. The mark point is 0.7 inches above the top of the steel casing.
 - TW 49 Test Well 49 was measured on 1/31/92 at 74.47 feet. The mark point is 1.1 inches above the top of the steel casing.
 - TW 50 Test Well 50 was measured on 1/31/92 at 61.0 feet. The mark point is 0.8 inches above the top of the casing.
 - PW 1 Plant Well 1 was measured on 1/31/92 at 109.59 feet. The pump was idle at the time I took the measurement. bolt that was surveyed is 0.19 inches above the casing used as the mark point elevation. Information about the pump and flow rates of PW 1 is included.
 - The water level PW 2 - Plant Well 2 information is included. of this well is difficult to measure because of an oil column in the well.
 - PW 3 Plant Well 3 was measured at 124.64 feet. The pump was operating at the time. This well operates continually and it

is difficult to find a time when a static water level can be measured. Information regarding the well construction, pump and pump curve is included. Currently the well is operated at approximately a 1000 gpm level.

PW 4 - Plant Well 4 was constructed without a port to measure the water level. It was designed to operate at approximately 300 gpm.

Kerr McGee Well Information

Kerr McGee is preparing to share in detail all of the information that they have gathered during the 1991 well installation program and the sampling that they have completed. This information will be shared during the meetings scheduled on February 10-11, at the Golder offices.

Surface Water Information

Blackfoot Reservoir - I have located the Water Master for the Blackfoot Reservoir. His name is Ed Hall his phone number is (208) 246-6668. I have been unable to reach him, if I do and he provides me some water level data I will get it to you.

Soda Creek Irrigation and Soda Creek flow - I have included copies of the water master's log book from 1983 - 1990. This information is mostly weir measurements at various locations. The North Weir was originally located above the Soda Creek Reservoir and in 1983 was moved below the reservoir and below the diversion point of the irrigation water. This location is where we collected the samples at Soda Creek. The South Weir (now is actually the North weir) is located at the outlet of the dam.

The elevation of the Soda Creek Reservoir spillway is surveyed at 5959 feet. The level of the reservoir is identified in the water master's log book as "level of dam." I have included a copy of the capacity table of the Soda Creek Reservoir. The capacity chart was developed when the reservoir was constructed. It has not been adjusted to reflect any silting since construction.

The measurements at the Farmer's Irrigation & Diversion weir indicates when and how much water was diverted from Soda Creek into the irrigation system.

The former water master indicated to me that prior to 1985 there was always a surplus of water.

As you know the purpose of the reservoir is to store water to supply the small Soda Springs City power plants located down stream on the creek.

Leakage and springs between the dam and the Farmer's Land & Irrigation weir has been measured with the dam headgate shutoff at 21.28 cfs.

LAYNE & BOWLER PUMP COMPANY FIELD TEST REPORT

Non	santo Chemical Co.	_	Well No	, <u>l (ivo</u>	rth well)	
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ىلىر. كالام Co	nonal Flact Ser No.			Frame		
ם ם טוני <u>ה אוי</u>	neral Elect. Ser. No. 125 RPM	1770	Volts 480	Amps1	<u>45</u> Cycle _	60
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ngine Mtr						
EST DATE	S:	8/10/67				
(832Me	Airline, Static					
eadings	Airline, Pumping					
n Lbs.	Discharge Head			 		
irline Length	- Foot	2001-0"		<u> </u>		
Urtine Static	Pressure — Feet	87!5"				<u></u>
ST	ATIC WATER LEVEL	112'-7"				
Virline Langth	- Feet	200'0"				1 144
Airline Pumpir	ng Pressure – Feet	831-2"				
	PUMPING LEVEL	116'-10"				
Discharge Hea	nd Feet	161'-7"			1	
	TOTAL HEAD-Foot	2781-5"				
	Pumping Level - Feet	<u> 116'-10"</u>		<u> </u>	 	
	Static Level - Foot	112'-7"			-	- 4-3-27
	DRAWDOWN	41-311				1
	Pilot 3.5 average	Collins		<u> </u>	 	
Flow Reading	Orifice				 	
Kasong	Other					
	GPM	900				7 = 1
CAPACITY	Miners inches	100	ļ	 		
GPM Per Foo	ot Drawdown	209.5		 		
METER DAT	A: Reva/Sec					.
KW Input						
HP Input					<u> </u>	
BHP Input to	Pump & % Motor eff.		<u> </u>			
PUMP RPM						
LOAD Volts						
LOAD Amps			<u> </u>			
Water Horses	oower			<u> </u>		
Pump Efficie	ency		<u> </u>			
Overall Effic	clency					
KWH per Ac						<u></u>
Pump Sett Column Si		200'-0" 1-11/16" ??		Discharge dia.	10‡" I.D.	
Remarks:	Also used electri and pumping level	c draw dow	m gauge t	o check bo	th static wa	ater le

Tested By: T.M. Thompson - Layne & Bowler Fump Co: Glen Turner - Hel Brown Co.

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LAYNE & BUTLER - LINE CUMPANT

FIELD TILT REPORT

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(Stages & Type)	<u> </u>	10" JKH	X III		1 1	o el
	(Stages & Type)	2 % Motor eff. 143'-((Stoges & Type)	(Stoges & Type) Sed electric draw down gauge to amping levels. Pitot tube setti	e % Motor off. 143'-6" Discharg (Stages & Type) sed electric draw down gauge to get both amping levels. Pitot tube setting very	Stoges & Type) Sed electric draw down gauge to get both static cumping levels. Pitot tube setting very close t	## Motor eff. 1431-6** Discharge dia. 102***

Tested By: T.M. Thompson - Layne & Bowler Fump Co.

Glen Turner - Mel Brown Co.

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Draw down gage with necessary piping

10 inch non-slow check valve - Crane

between pump discharge and non-slow check valve.

2 inch air relief valve with 2" gate valve and necessary connections

Pipe, flanges, gaskets, bolts and valves necessary to furnish a complete

10 inch gate valve - Crane

installation of a turbine deep well pump through the check valve and flanged gate valve.

Motor

125 - HP - 6000 foot elevation. 1800 RPM Vertical - Hollow Shaft Electric Motor drive - 1100 volts - 60 cycle - 3 phase with Square D weather tite pumping plant combination starter panel for above motor.

Monsanto Chemical Company to furnish only a concrete base around the well and casing.

WITH ELECTRIC Motor & Comin State

The above well and pump completely installed without electric wiring for the lump sum of \$11,406.50.

1, 2, 90 fr 13 and 100 fr of 4

CURVE NO. 51287 E. of =9 7/7/67 JWC FIELD PERFORMANCE STAGE 10 UKH-XH PUMP 1770 __ R.P.M. - FOR -MONSANTO CHEMICAL CO FIELD CAPACITY BRAKE HORSEPOWER GALLONS PER MINUTE 600 12:00

FIELD TEST REPORT

wner:	onsanto Chemical	Co		# # II INO.		2112	<u> </u>	Danah	2755
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tor Mfr. G	avne & Bowler eneral Elect Ser. No 00 HP RPM_)		1.00	rame		225	Cycle	60
H.P. <u>2</u>	OO HP RPM_	1770	_Voits .	480	^	mps	<u> </u>	_ cycle _	
wer CoU	tah Power Meter	No		(h		C.T.R	atio		
gine Mfr.									
EST DATE	S :	8/10/67							
1038U10	Airline, Static	None				<u> </u>	· 		
eadings	Aldine, Pumping	None					-		
Lbs.	Discharge Head	184.80 F	SI						
irline Length	- Foot	None					<u> </u>		
iriine Static	Pressure — Foot	None							
51	ATIC WATER LEVEL	122'-7"							- "7.274-74"
Airline Length	- Feet	ļ <u></u>					 		
Airline Pumpi	ng Presade Pest						 		
	PUMPING LEVEL	1241-3"					 		
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	Static Level - Feet	1221-7"							-
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on - Layne & Bowler Pump Co.

No.3 Well

CURVE NO.D 11521

OUTED BY HOS DATE 10-2-4 FT		FIEL PERFORMANCE
CITED BY Ex-		LE STAGE 1 - F D L. PUMP
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Burragiors

Chican 5/22-2794 Comp and Med Orilling Engliment Incested #3 Well Pumps

1267 E. 17th Ca., Ideho Falla, Idaho

FURS ESSENCIO WATER IS THE SECURICE OF LIFS, LET US SELL YOUR WITH, AND YOU WAIL SE SATISFIED.

U El: <u>Handanda Adamidad Bad</u> ISS: <u>Boda Baxanga, Idaha</u>	DRILLER: Wordl Harbat. MG NO: 361-6 Demostic Industrial Municipal
I ICCATION: USC No. 3 Foot of Office Deficient AL DISCHIPTION:	Trrigation fost woll Other
THE TO WATER: 1050 RIC TIME: REMARKS:	FOOTAGE: FOFMATICA:
2.2005	0-5 Way
Pock Milian & Firming straighting beloCot 12 to 15-16	25-30 Black rock
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#3 deep well

70 H 97309

Pamps

Arril rerbat ___ in a..... PRILLIP: Henwante Chestish Company FORMATION FOOTAGE: ER AFKS: 7<u>10 NO:</u> Rocken mich & Maleira - ne 59-60 Broken mark & sincere - 201 60.55 Broken black lava ruck 1,5-70 Primen black lava rock 70-75 Surke: 75-80 Caving 80-85 Hot formation 7115" p# 20" pipe 96. Caving 85-90 Firm black lava rock 90-95 Total Langth of 20' pips 101'5" 95-100 100-105 17 105-110 110-115 115-120 120-125 125-130 Firm clack lava rock 130-135 Cindors - water 135-140 140-145 145-150 150-152 Firm black lava rock 152-158 Broken - water 158-160 Pim 160-155 1:5-170 170-175

#3 dup Well

91-09 Meo ± 97309

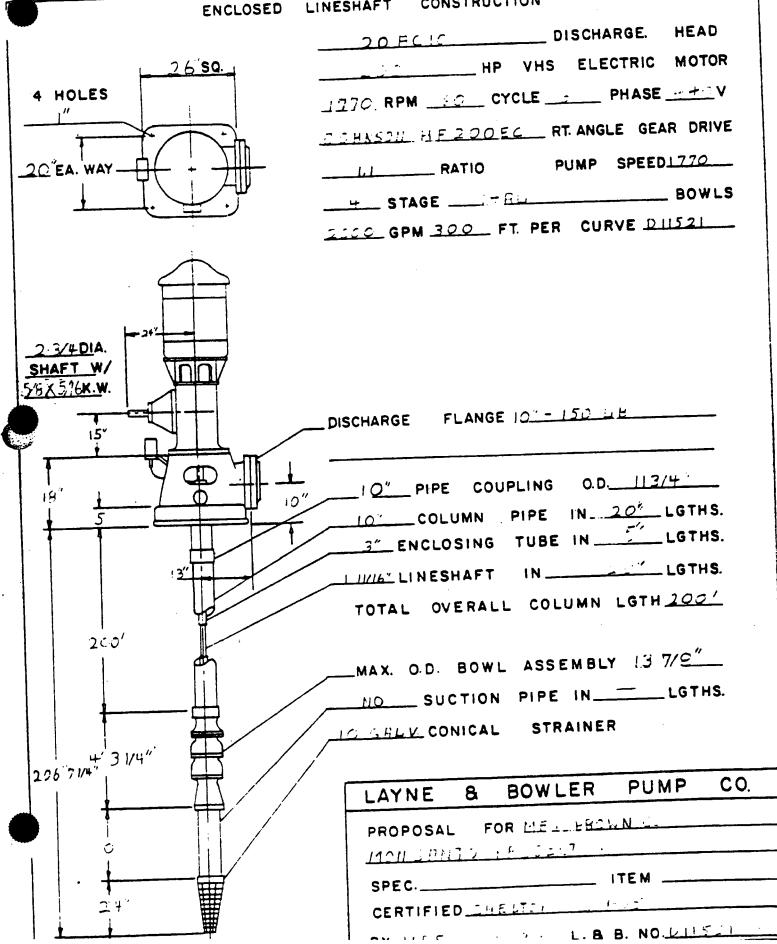
Rumas

DRILLED:___ transacto Chemical Company FORMATION! POOTAGE: FED AFAS: 970 <u>Not</u> Firm black lava rock 111 175-180 180-185 p. 1.2 Checking water temptum 185-190 Often. Temp. drepping slowly from 96° Broken - imtor 190-195 to 62° 195-200 9mm Pirm 200-203 Cindors - water 203-214 Firm rock - lava 224-220 220-025 Cindoro - mater 225-230 Firm have rock 236-235 235-240 240-245 245-250 250-255 Installed five joints of 16" perferated pire & three joints of plain pipe. One 16" drive shoe on better of pipe. First joint to plain pips 20747, nort three joints is perferated. Lengths of cach 18 2013" - 2012" - 2012" One joint of plain pipe next 2013", then two joints of porforated - 2012" and 2011 last one -- joint of plain 20' everall measurement 161°5"

ne DEEP WELL PUMP



LINESHAFT CONSTRUCTION



SONA CREEK RESERVOIR CAPACITY TABLE

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sp. Il way at South and Dain -1983 24 fret across well werk Kickles Sect x 3fist gate ordam outh weire - Steel x 3 lest Close dans down 1/2" 57.5 306 Tokquen - 3th wide Stake 8" obout wik Kackleys # Jamas 4th wide 57.3 Law. 481 widE FORMERS Land & IRRIG - 39. - WICE
Shift Azads 1.08 when
Water is level with weir
Water is level with weir 564 C 252d Mens Cellan 3.2 c.f. opened 15 Thins Wilda Thompson Detwide 5 / WE. W 85 w.dz 23 Leskage & springe between dams & F.L. II. weir Woom shut of pressures approx. 21.28 c.f.s 31 251 85.0 1.6 **ACCOUNT BOOKS** 144 PAGES • 7% IN. x 51/4 IN. (20 cm x 13.4 cm) **AVAILABLE AS: JOURNAL** No. 64-5400 (2044-J) S.E. LEDGER No. 64-5402 (2044-SEL) D.E. LEDGER No. 64-5404 (2044-DEL) CASH No. 64-5406 (2044-C) spillway. 14 RECORD No. 64-5408 (2044-R) RECORD-Ind. A-Z No. 64-5482 (2044-1) VERNON MCMILLAN.Inc., ELEMETHINJ 07208 full pond - ft 1.561.4

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7-20-87 9:30	1 100/60	1.63	
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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY **REGION 10**

1200 Sixth Avenue Seattle, Washington 98101

July 15, 1993

RECEIVED

Jul 1 6 1993

Reply to

Attn of:

ES-097

SUPERFUND REMEDIAL BRANCH

MEMORANDUM

SUBJECT:

Monsanto Site - Phase II Remedial Investigation Air

Emission Inventory (Dated May 27,1993)

FROM:

Bill Ryan /3. / L Environmental Characterization Program

TO:

Tim Brincefield

Remedial Project Manager - Superfund Branch

I have completed my review of the Phase II RI air emission inventory (EI) and find that the information contained therein offers a clearer, more defensible, characterization of most of the sources at the facility than that contained in the Preliminary Site Characterization Report. It is also worth noting that there still remains a high degree of uncertainty related to several sources/source areas on the site. The following comments are based upon my review of the EI report itself, our meeting with Monsanto on June 24, my visit to the site on June 29, and a subsequent phone conversation with Dan Hrebenyk of Senes Consultants. The comments are related to the EI (and how Monsanto is proposing to use it) as well as other work to be conducted in the future.

In general, here is my understanding of how Monsanto intends to use the information contained in the EI. They intend to conduct modeling with the subject EI in order to derive an initial estimate of risks associated with air releases from the site. The intent of such an exercise is to identify (with presently available information) sources which contribute significant (or potentially significant) risks through the air pathway. This will help define and focus potential future work (if needed) related to source characterization. The modeling will be conducted in a manner such that changes to estimated emission rates based on updated information can be easily translated into predicted ambient air concentrations and deposition rates without re-doing the entire modeling analysis. Since we are also interested in getting an initial set of modeling results to begin determining the potential significance of risks through the air pathway, this approach seems acceptable.

In order to get the modeling under way, certain assumptions need to be made for sources where there is significant uncertainty related to emission rates and/or release characteristics. Dan Hrebenyk and I have had discussions about such sources. The following comments reflect my understanding of our agreements on how to treat them for this modeling effort.

- Kiln venturi scrubbers: Trace metals and radionuclide emissions will be based on 1992 stack testing results. While changes to the control system were made prior to the 1992 testing, it is felt that the 1992 data provide a reasonable initial characterization of emissions from the scrubbers for 1990 and 1991. Evaluation of resulting risks should indicate whether additional information related to the metals and radionuclide make-up of the emissions from the scrubbers would be needed.
- Nodule crushing/screening scrubber (NCSS): The EI indicates that particulate matter emissions from the NCSS are assumed to be 28 lb/hr. Unfortunately, no justification or basis for this value is presented in the report. We recommend that the basis for this number be presented prior to initiation of the modeling.

The report indicates that stack testing of the NCSS will be conducted in the future (fourth quarter of 1993) and that this information will provide documentation/confirmation of emissions from this source. We request that Monsanto provide us with the date(s) when the testing would be conducted. We would also recommend, if feasible, that the testing be conducted at the earliest convenient date to facilitate the use of the results in further risk evaluation.

Taphole fume collectors (THFCs): The report indicates that particulate emission rates from THFC #8 were significantly higher in 1991 than in 1990 while emissions from THFC #9 remained essentially unchanged between 1990 and 1991. A discussion of possible reasons for the differences between the 1990 and 1991 emission levels for THFC #8 should be provided prior to initiation of modeling.

The EI uses the chemical composition of the sub-200 mesh fraction in the treater dust for characterizing trace metals and radionuclide emissions from the THFCs. For purposes of the upcoming modeling, this approach is acceptable. Stack testing of THFC #7 is currently scheduled for the fourth quarter of 1993. As with NCSS, results from this testing should provide documentation/confirmation of the chemical/radiological make-up of the emissions from these sources. As with the NCSS testing, we recommend that Monsanto provide us with the date(s) of sampling and encourage them to schedule the testing at their earliest convenience.

- 4) Coke fines air conveyor: The report shows 1986 emission levels for this source. Because emission rates from this source are low relative to others at the site, the difference in ambient air impacts (and associated risks) using 1986, 1990 or 1991 emission rates are not likely to be significant. Should modeling indicate potential risks from this source using the 1986 emission levels, further evaluation using 1990 and 1991 levels would be performed.
- Furnace building fugitives: The calculations of fugitive particulate matter emissions from the furnaces assumes several different control efficiencies for the venturi scrubbers (84-92 percent). While it is reasonable to expect some variation on control efficiencies, it is difficult (if not impossible) to determine when any given efficiency is being achieved. Consequently, for purposes of estimating emissions from the furnace building, we recommend that a single control efficiency be used for all furnaces, unless there is sufficient information to support the use of different, furnace-specific control efficiencies. For purposes of the upcoming modeling exercise, a 90 percent control efficiency value seems acceptable.

For purposes of the upcoming modeling, fugitive fluoride emissions from the furnace building will be modeled at a rate of 0.43 lb/hr. A material balance of the furnace area suggests that this rate may be overstating actual emissions. However, lacking any additional information to derive a different factor, these emissions will be used in the initial evaluation of risks through the air pathway.

6) Slag Pouring Emissions: Section 3.3.6 of the EI report presents a variety of emission factors for use in estimating particulate matter emissions from slag pouring activities. Estimated emissions presented in Tables 3.3.2a and 3.3.2b are based on an emission factor of 0.282 pounds of particulate matter per ton of slag tapped (lb/ton). on discussions with Dan Hrebenyk, utilizing information in Section 3.3.5 of the report, an emission factor of approximately 0.57 lb/ton will be used in the upcoming modeling analysis. This value, which is roughly double the value proposed in the EI, tends to fall near the middle of the range of factors identified in the report and is consistent with the methodology used for estimating fugitive dust emissions from the furnace building. In the event that modeling suggests risks associated with this source may be significant, I would recommend that Monsanto begin to think of potential source testing methods for evaluating emissions from this activity.

Fluoride emissions from slag pouring will be estimated using a factor of 1.043 lb/225 ft 3 of slag (the origins of which are uncertain). The mass balance performed for furnace-

related fluoride emissions would suggest that this factor results in a significant overestimate of emissions from slag pouring. Given the lack any other factor to use at this point in time, and an indication that this approach may be conservative, this appears to be an acceptable approach to use for the forthcoming modeling exercise.

7) Slag Pouring Modeling: Appendix E of the report presents an evaluation of several methods of modeling the emissions from slag pouring activities. Conclusions of that evaluation include a proposal to simulate the release and dispersion of emissions from slag pouring activities as a pseudo-stack Based on my recent site visit, it appears that the pouring of slag on the pile would (as indicated in the report) be best simulated as a buoyant puff release. Unfortunately, models currently available for regulatory use do not easily lend themselves to evaluating such sources with large meteorological data bases, such as being used at Monsanto. Consequently, Monsanto/Senes has proposed to simulate these emissions as a pseudo-stack source as a surrogate for modeling them as a puff, which will incorporate buoyancy effects that were not accounted for in the earlier modeling analysis. My major concern with the proposed methodology is associated with the fact that slag dumping activities occur at various locations on the slag pile throughout the course of a year. The locations of model-predicted air concentrations and deposition rates can be very sensitive to the placement of a given stack (or puff release, for that matter) within the modeling domain. When looking at short-term events (up to 24 hours in duration), modeling the slag pouring in the proposed fashion may be reasonable since the location of slag pouring is relatively constant on a single day. However, for assessing longerterm impacts, the method may not provide as good a description of concentration/deposition patterns and magnitudes because model predictions would likely to be overstated in some areas and underestimated in others due primarily to source placement. I had recommended that Senes consider treating emissions from slag pouring as a volume source (as was done in the previous modeling), but to expand the dimensions of the volume to account for buoyancy effects and the migratory nature of the pouring activities. has evaluated this approach and found that it is not a significant improvement over the earlier modeling. Consequently, Dan and I have determined that the following approach will be used for the upcoming modeling. Slag pouring will be modeling two ways; 1) using the pseudo-stack approach proposed by Senes and 2) using a series of pseudostacks to simulate the slag dumping. Since neither approach can be viewed as "correct," we agreed that predictions from the method yielding the more conservative (higher) concentrations would be incorporated into the results that would be provided to EPA/SAIC for initial risk evaluation. Obviously this is an area which needs further investigation.

but for the short term I think we can begin to generate information which will help us get a feel for risks through the air pathway.

Finally, on a topic not specifically associated with the EI report itself, but related to future work. In our meeting of June 24, and subsequent discussions, there has been some dialogue related to the usefulness of some ambient air quality monitoring in the vicinity of the Monsanto facility; primarily as a "reality check" for the emission inventory and modeling. It is my understanding that Monsanto has written you agreeing that some monitoring would be necessary. Dan Hrebenyk and I have had some initial discussions related to a monitoring program and it is my recommendation that they provide a proposal which outlines the purpose and goals of the program and a description of the program Ideally this plan should include a description of the itself. network (location, duration, sampling frequencies), constituents to be identified, analytical procedures and techniques to be employed (and laboratory-specific SOPs) with estimated detection limits, and a description of QA/QC practices to be followed.

Should you have any questions regarding these comments, or my review in general, please give me a call.

cc: C. Hall (AT-082)

Dose-Rate Measurements and Shielding-Factor Calculations for the Monsanto Company Elemental Phosphorus Plant, Soda Springs, Idaho

Authored by:

J. Alvarez. Ph.D., C.H.P. International Technology Corporation

Edited by:

W. Wright, R.E.P. Montgomery Watson

Date: September 13, 1994 Phosphate ore is often associated with uranium concentrations that are slightly elevated with respect to the U.S. average for soils. As a result of the increased uranium, gamma radiation from uranium progeny is also somewhat increased above the U.S. background average. The dose rate from phosphate ore and processing by-products is usually well below dose rate levels that are subject to regulatory action. The relevant regulation for occupational situations is 29 CFR 1910.96, administered by the Occupational Health and Safety Administration. A review of the occupational dose rate situation of the elemental phosphorus plant operated by Monsanto Company in Soda Springs, Idaho, was conducted to ensure that doses received by workers were below levels requiring establishment of restricted areas and the institution of a radiation protection program.

Monsanto Company has a radiation protection program administered from the corporate level that satisfies both OSHA and Nuclear Regulatory Commission regulations. The Soda Springs plant has radioactive gauges that are licensed by the NRC, and an appropriate radiation protection program to meet those license requirements is in place. Workers are not exposed to the radiation emitted from these gauges on a regular basis.

The major source of worker exposure is the naturally occurring radioactivity found in the materials used and generated during phosphorous production. Because of possible external and internal exposure. Monsanto conducts routine radiological surveys to ensure that worker doses from these materials are not in the range requiring an OSHA radiation protection program.

The current investigation determined both shielded and unshielded dose rates at typical work locations. Measurements were obtained on August 3, 1994, with a Bicron Microrem Meter, a tissue-equivalent plastic scintillator. Shielded dose rates were those inside vehicles or equipment used at those locations.

The measured dose rates by location are shown in Table 1. The shielding factors ranged from 0.75 to 0. The shielding factors (or dose-reduction factors, DRFs) were determined by the following formula:

 $DRF = \underbrace{D_1 - bg}_{D_2 - bg}$

DRF = dose-reduction or shielding factor

D1 = unshielded dose rate D2 = shielded dose rate bg = background dose rate

(Note: EPA uses a shielding factor denoted as Se; DRF = 1-Se)

The background at the plant boundary where slag was not present was 15 μ rem/hr. Several locations within the plant boundary, inside buldings and the quartzite and coke piles were lower than the plant boundary background. The background used in determining the shielding factors was 15 μ rem/hr. The shielding factor is applied by multiplying DRF times the above-background dose rate.

A person walking through a location has a DRF of 1. A person riding in an automobile or pickup has a DRF of about 0.5. A person operating the heavier equipment such as ore trucks, caterpillars, or pot carriers has a DRF of or nearly 0. The highest dose rates are thus experienced when walking outdoors, the next highest are experienced when riding in light vehicles, and often no excess dose is experienced when operating heavy equipment.

The projected doses can be calculated based on time at locations and can be bounded by highest and lowest dose rates. The highest dose rate measured was 75 µrem/hr, or an excess dose rate of 60 µrem/hr. Based on 2,000 hr/yr worked, the maximum annual dose is 120 mrem/yr. For a worker receiving this maximum dose from age 18 to 65, the annual risk at age 75 is 1x10-4. The minimum dose is background, so no excess risk is projected for the lowest dose-rate category. It is clear from the dose distribution at the Soda Springs plant that no individual is exposed at the highest dose rate for even a single day. This upper-bound dose and corresponding risk estimate are definite exaggerations. A more probable estimate of the maximum average daily rate is 45 µrem/hr for an excess annual dose of 60 mrem/yr. This dose rate would produce an annual risk of 5x10-5 at age 75. The person expected to receive such doses are those who spend a major portion of the day on foot and outdoors. In general, weather restricts outdoor activity for several months of the year.

A study was conducted using thermoluminescent dosimeters on 25 workers. The doses from this study resulted in projected annual doses ranging from 1 to 66 mrem/yr. This is well within the error of the annual doses projected from dose rate and time. The period of this dosimetery study was late summer to late fall. Outside activity was restricted to only a small part of the time for the vast majority of workers.

Conclusions

Dose rates at single locations and annual doses are below limits requiring establishment of radiation areas and a radiation protection program. An area must be designated a radiation area if is any area that in which there exists radiation in such levels that a major portion of the body could receive in any one hour a dose in excess of 5mrem, or in any five consecutive days in excess of 100 mrem (29 CFR 1919.96.d.3.ii). A radiation program is required for surveying for radioactive materials and radiation dose rates and for providing appropriate dosimetry devices to each employee who is likely to receive 10% of 5 mrem/yr. An airborne radiation program is required when an employee is expected to receive 10% of the annual limit of intake. Further, a radiation program is required when a minor or a fetus/embryo of a declared pregnant woman can receive 1% of 5 rem/yr. None of the above doses can be received at the Soda Springs plant based on the results of this study. Minors do not work at the plant and 50 mrem cannot be acquired over the nine months of a pregnancy.

Gamma Radiation Dose-Rate Measurements

Monsanto Company's Elemental Phosphorus Plant Soda Springs, Idaho 3-Aug-94

Dose Rate (microrem/hour	Dose	Rate	(microrem/hour)
--------------------------	------	------	-----------------

Unshielded	Shielded	Chialdina Fastat	T		
32	20	Silleraing Factor	Type of Shielding	Location (grid no.)	Location Description and Comments
48	22	0.29	automobile	44	outside service building
45	15	0.21	pot carrier	44	outside #8 furnace
35		0.00	pot carrier	44	west of #8 furnace; pot full
45	11	0.00	pot carrier	34	slag dump; metal ramp w/ pot full and empty
10	17	0.07	pot carrier	44	west of #8 furnace
	10	0.00	pot carrier	44	#8 furnace alley
38	25	0.43	automobile	34	road on slag pile to slag dump
50	30	0.43	automobile	34	metal thumper
45	25	0.33	dump truck	34	metal thumper
15	15	0.00	automobile	45	coke pile
6	6	0.00	automobile	55	quartzite pile
53	21	0.16	ore truck	65	ore pile
40	25	0.40	automobile	65	ore pile
5 1	35	0.56	automobile	65	•
52	39	0.65	automobile	65	ore pile
60	40	0.56	pickup	65	ore pile, blend 1
65	15	0.00	D9 cat	65	ore pile, blend 1
58	40	0.58	automobile		ore pile, blend 1
40	25	0.40	automobile	75 76	underflow solids
40	15	0.00	dump truck	76 70	baghouse dust
45	35	0.67	automobile	76 74	baghouse dust
42	22	0.26	automobile	74	electrode seal pond
45	30	0.50	automobile	73	sanitary landfill
75	50	0.58			sanitary landfill
48	25	0.30	automobile	64	nodule area; between two stockpiles
10	10	0.00	automobile	64	treater dust
	• •	0.00	automobile	54	fuel tanks

Gamma Radiation Dose-Rate Measurements, continued

Dose Rate (microrem/hour)

	,				
<u>Unshielded</u>	<u>Shielded</u>	Shielding Factor*	Type of Shielding	Location (grid no.)	
43	35	0.71	automobile		
43	22	0.25		54	kiln
52	40		front-end loader	54	kiln
52		0.68	automobile	44	nodule screening pile
	15	0.00	ore truck		
60	17	0.04	front-end loader		nodule screening pile
45	35	0.67	automobile		nodule loading
35	30	0.75	· · · -	53	old underflow solids
60	38		automobile	53	effluent settling pond; slag gravel
00	30	0.51	automobile	23	sewage evaporation pond
					aa

^{^1} denotes no shielding, and 0 denotes complete shielding; negative results are replaced with 0 (physical constraint).

APPENDIX B SOURCE PHYSICAL PROPERTIES

APPENDIX B-1 PHASE I SAMPLES

SCHEDULE OF LABORATORY TESTS

																			_				
																							DATE IN 11-4-9 \ DATE DUE
FI	1031	.01	1.4	O I V	ر ۱۰						<u> </u>	• -							· –	<u>`</u>			
BORING	SAMPLE	Atterberg Limits	Moist. & Desc.	Wash Sieve	Std Proclor	Sieve & Hydro	Specific Grav.	Shelby Ext.	Consol.	M	3	Slake Dur.	CBR	Unconf. Com.	F.W. Perm.	R.W. Perm.	Recompact		Min. Resisitivity	Vane Shear	Dry Sieve		COMMENTS
slag-1																					4		Engineer's Copy
slag-Z						18		Trees.															
slag-3						T.W.L.						,											
dust - 1						W/ 748				·													
S-Feub						1																	
dust-3						1000																	
underflow — 1						1															显		
underflow -Z														١							i de la companya de l		
underflow -3			顶			The state of													0			· >	Could not du dry sieve
Sporth-1			N. I.			4111	30	Î													池		
	Test Starte	d		353.8		Engi	inee	er g	ive	n			1	ah~	1521	i o c	, e.	ıbe	ite		-sti	00	only for CIIIIII and

Billed

consolidation tests. Drafting billed to project directly.

SCHEDULE OF LABORATORY TESTS

	PR PF	OJE	C1	T (NU SH	Ю М	RT BE	R_	ГI7 913	ΓL1 3-	E <u>1</u>	10n	sa.	nto	<u> </u>	1 <u>1</u> 28	U	F: E	s NG	aR	<u>/_</u>	1 <u>1</u>	<u> </u>	20	DATE IN_11-4-91
	BORING	SAMPLE	Atterberg Limits	Moist. & Desc.	Wash Sieve	Mod. Proctor	Std. Proctor	Sieve & Hydro	Specific Grav.	Shelby Ext.	Consol.	M	8	Slake Dur.	CBH CBH	Unconf. Com.	F.W. Perm.	R.W. Perm.	Recompact	Hd	Min. Resisitivity	Vane Shear	Dry Sieve		COMMENTS
Slure	Y- Z							The last																	
slust	y-3							MIN		,														. 1.1	
		 :																							
<u>-</u>																									
														!											
				-																	-				
, <u> </u>	Пт	est					Er	nain	188	ر 0	ive	n	·	1		•	•	•	•		•	*			

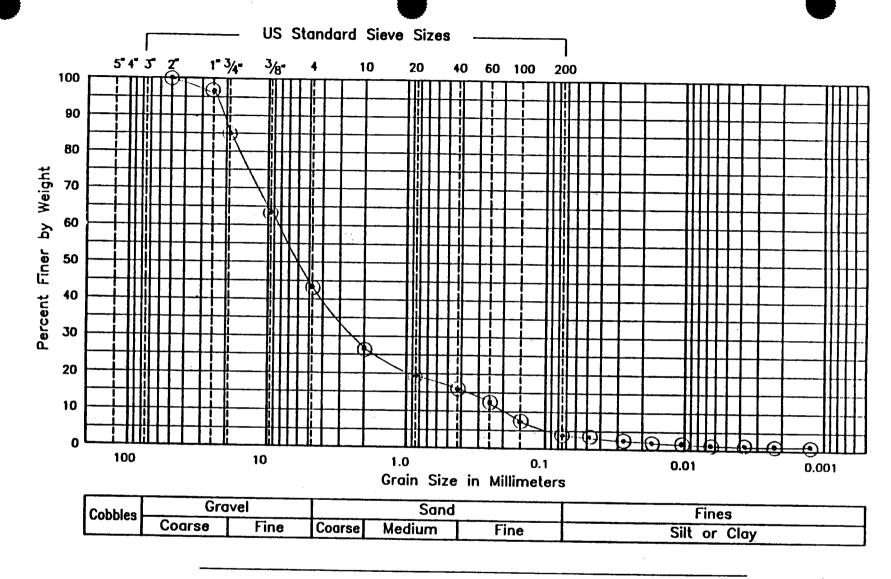
Test
Completed

Started



Engineer given copies

Laboratory submits drafting only for CU,UU and consolidation tests. Drafting billed to project directly.



Boring No.	Elev. or Depth	Wn	WL	Wp	l _p	Description
5Lag-1.		4,5				Medium gray (N5), c-f GRAVEL and c-f SAND, trace silt, (GP).

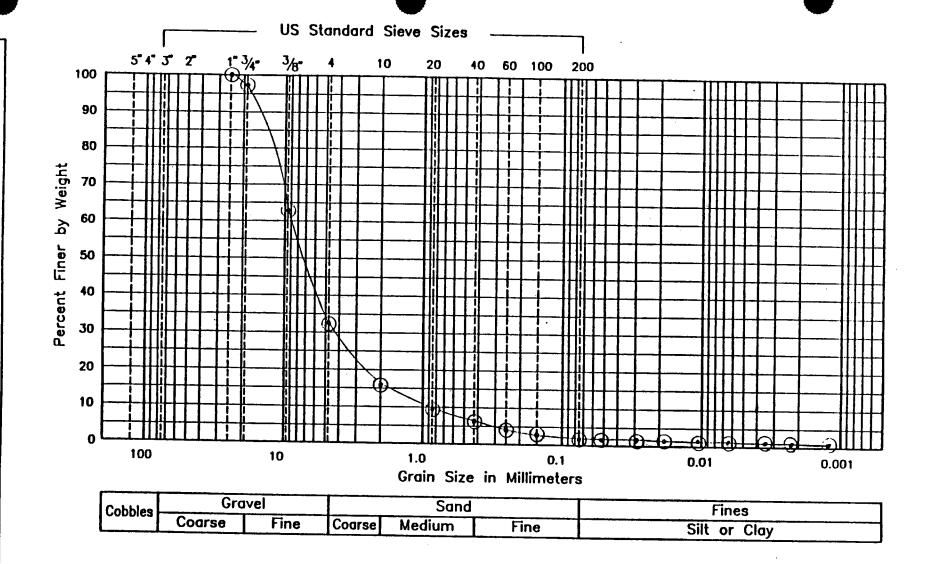
GRAIN SIZE DISTRIBUTION >-422

By 14 = ADDONNAM BY 17PD

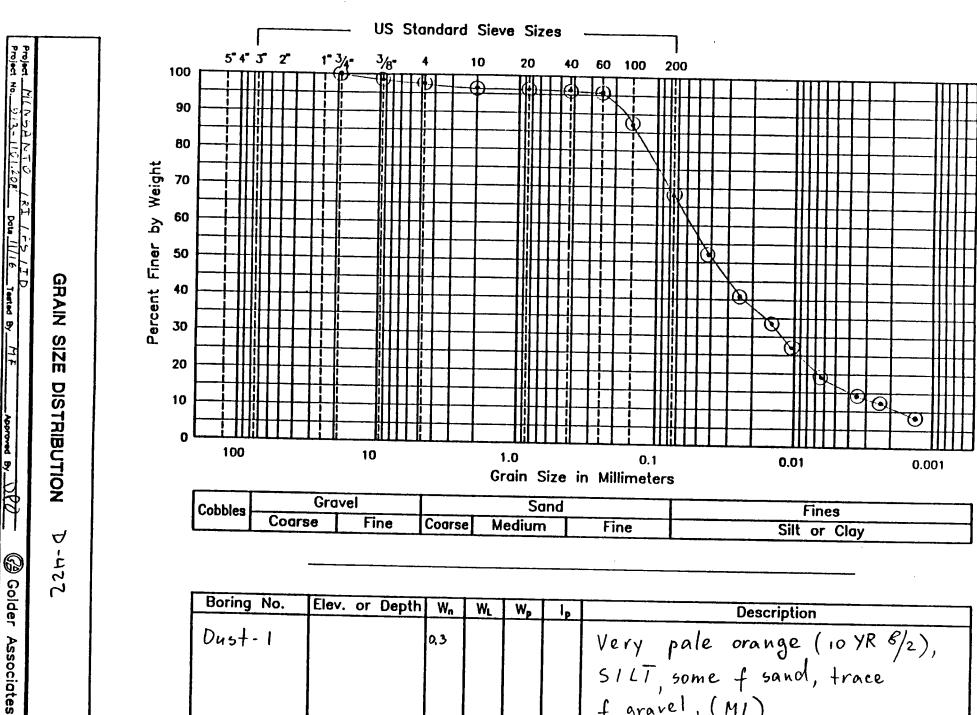
(2) Golder Associates

US Standard Sieve Sizes 5"4" 5" 2" 1" 3/4" 20 200 40 60 100 100 90 80 by Weight 70 60 Finer 50 GRAIN SIZE DISTRIBUTION 40 Percent 30 20 10 100 10 1.0 0.01 0.001 Grain Size in Millimeters Gravel Sand Fines Cobbles Coarse Fine Coarse Medium D-1140/C-136 Fine Silt or Clay Boring No. Elev. or Depth Wn WL Wp Description Medium gray (N5), c-f GRAVEL, some c-m sand, trace silt, (GP). SLag-2 0.5 **Associates**

Golder



Boring No.	Elev. or Depth	Wn	WL	W _p	وا	Description
Slag-3		3,8				Dark gray (N3), f GRAVEL and c-f SAND, trace silt, (GW).



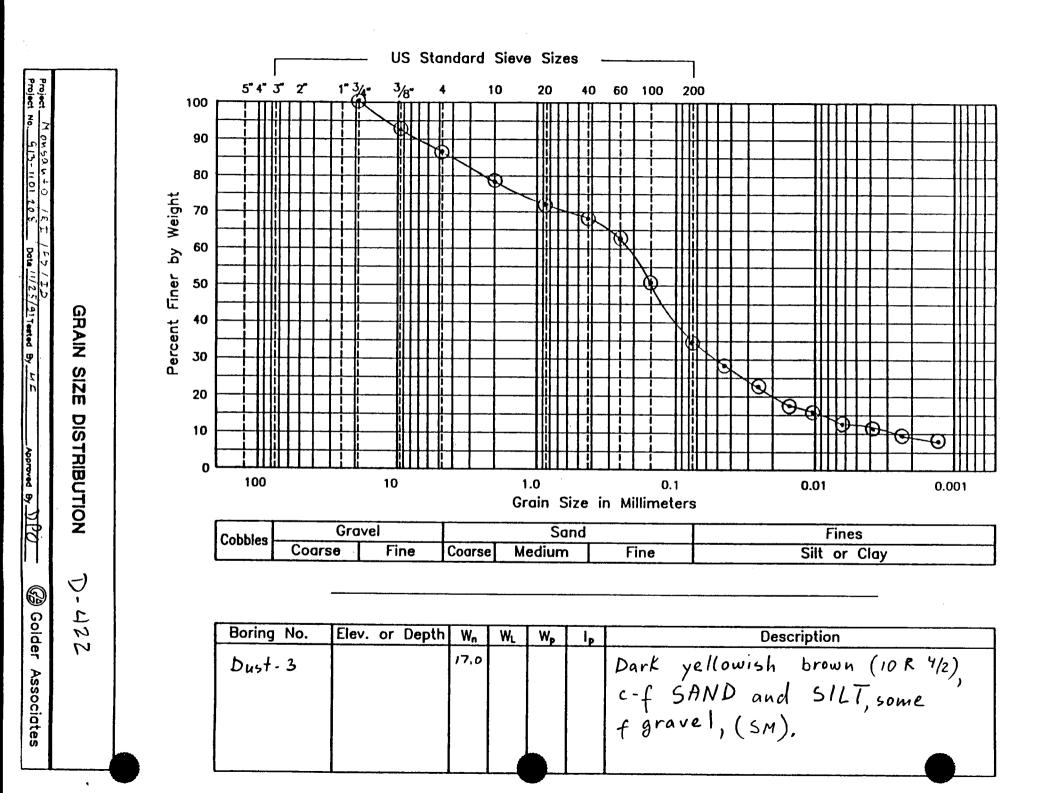
Boring No.	Elev. or Depth	Wn	WL	W _p	l _p	Description
Dust-1		0,3				Very pale orange (10 YR 8/2), SILT, some f sand, trace
						f gravel, (ML).

US Standard Sieve Sizes 5" 4" 3" 20 40 60 100 200 100 90 80 Percent Finer by Weight 70 60 50 GRAIN 40 **30** SIZE 20 DISTRIBUTION O. 10 3 100 10 1.0 0.1 Grain Size in Millimeters D-422 **(** Golder Associates

0.01 0.001

Cobbles	Gra			Sand	_	Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay	

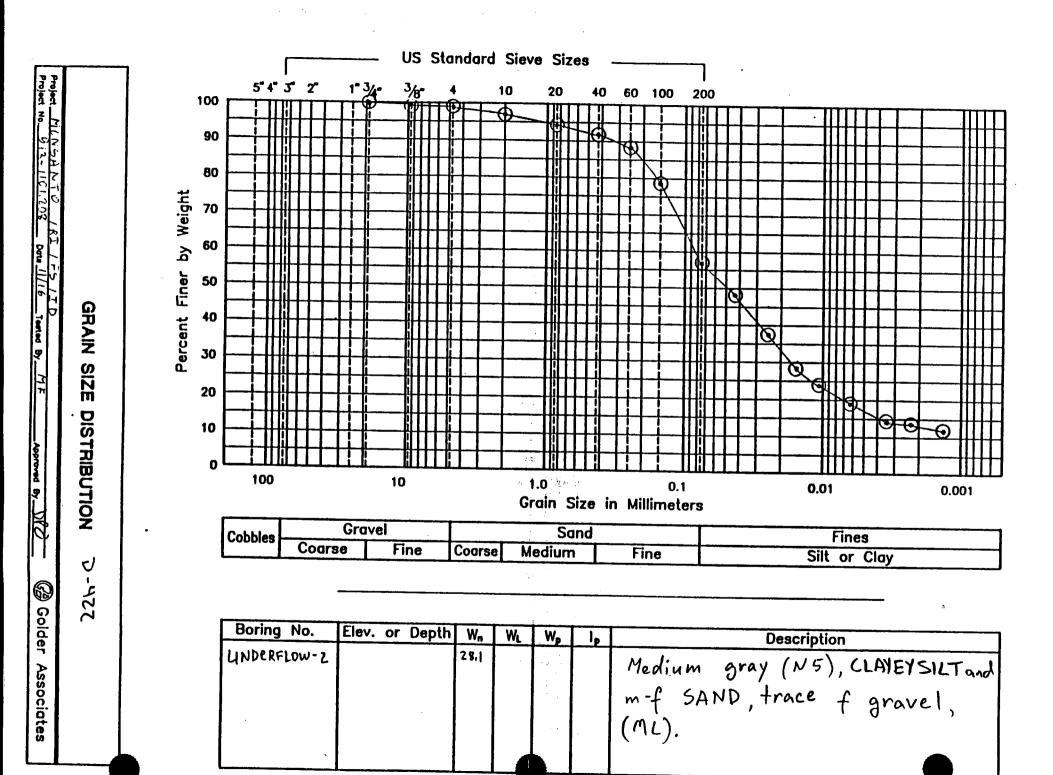
Boring No.	Elev. or Depth	Wn	WL	Wp	-lp	Description
Dust - 2		6.8				Dusky yellowish brown (10 YR 3/2) c-f SAND and c-f GRAVEL, some silt, (SM).

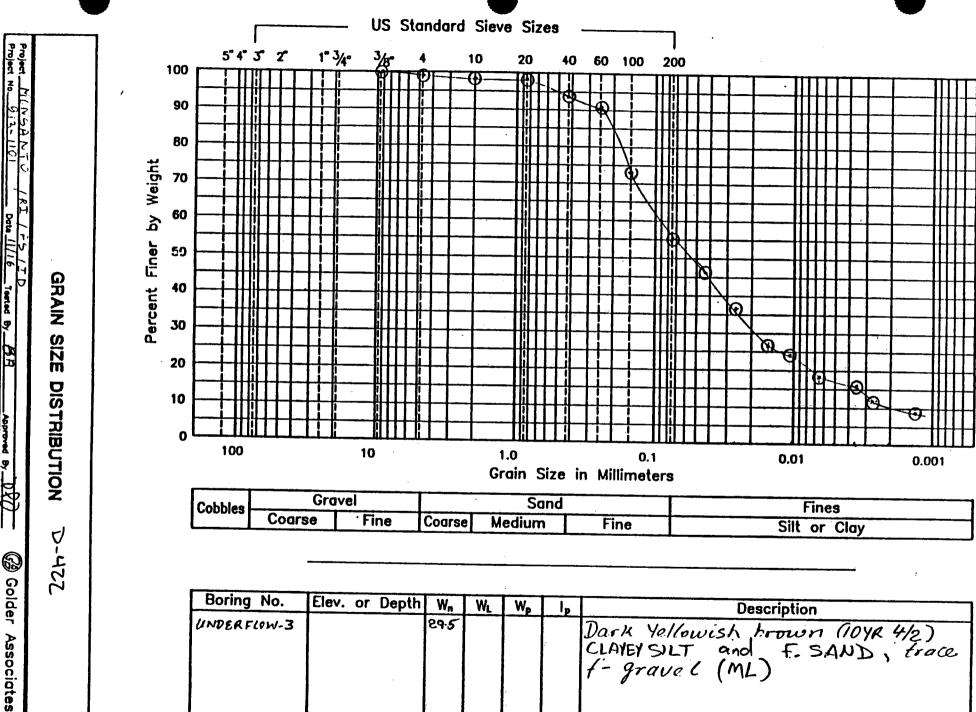


GRAIN SIZE DISTRIBUTION D-422 Golder Associates

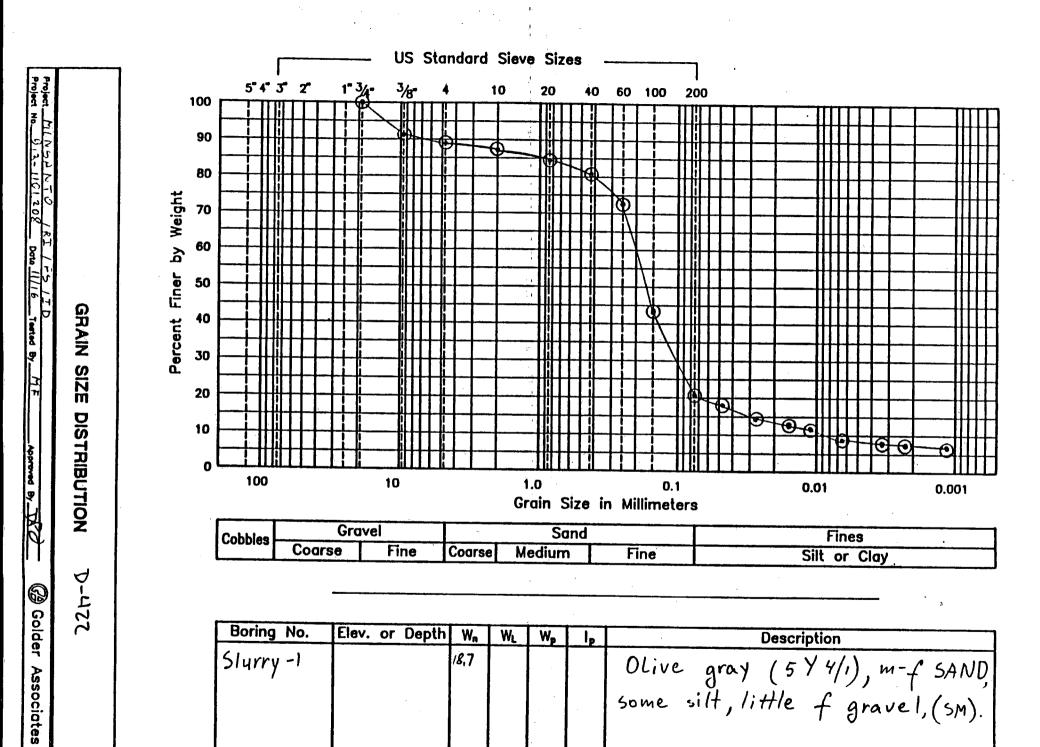
US Standard Sieve Sizes 5" 4" 3" 1" 3/4" 20 40 60 100 200 100 90 80 Percent Finer by Weight 70 60 50 40 **30** 20 10 100 10 1.0 0.01 0.001 Grain Size in Millimeters Gravel Sand Fines Cobbles Coarse Fine Coorse Medium Fine Silt or Clay

Boring No.	Elev. or Depth	Wn	WL	W _p	l _p	Description
4N DERFLOW-1		19.0				Light olive gray (54 %), CLAYEY SILTandc-F SAND, trace f gravel, (ML).





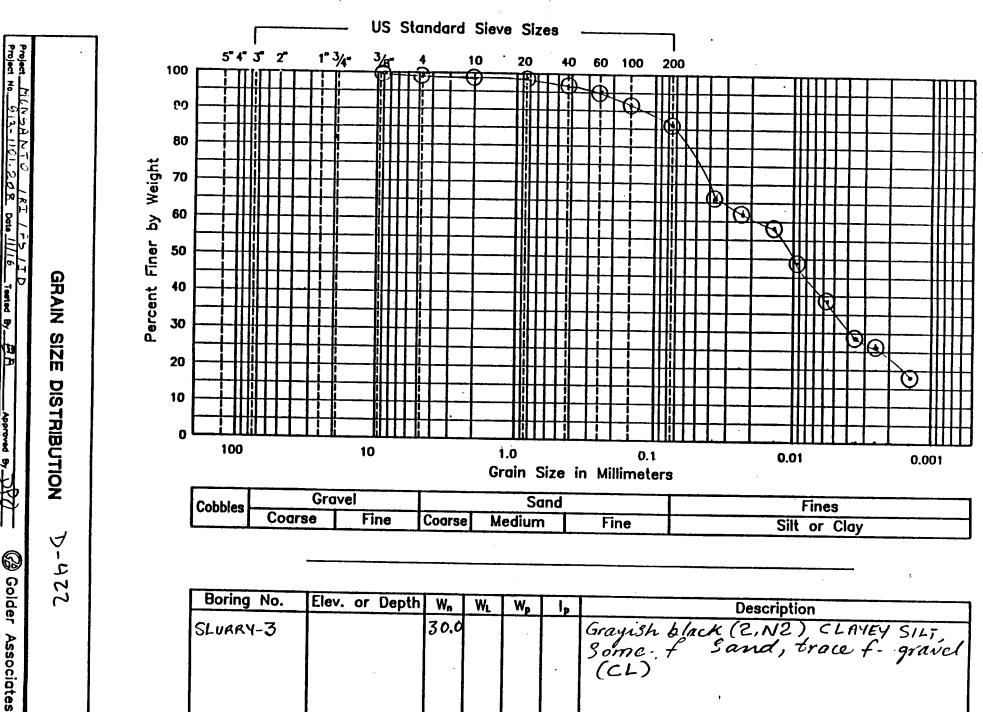
Boring No.	Elev. or	Depth	Wn	WL	W _p	l _p	Description
UNDERFLOW-3			29.5				Dark Yellowish hrown (104R 4/2) CLAYEY SILT and F. SAND, trace f-grave (ML)



GRAIN SIZE DISTRIBUTION 22H-Q Golder Associates

US Standard Sieve Sizes 5"4" 3" 60 100 200 100 90 80 by Weight 60 Percent Finer 50 40 **30** 20 10 DIO 100 10 1.0 0.1 0.01 0.001 Grain Size in Millimeters Gravel Sand Fines Cobbles Coarse Fine Coarse Medium Fine Silt or Clay

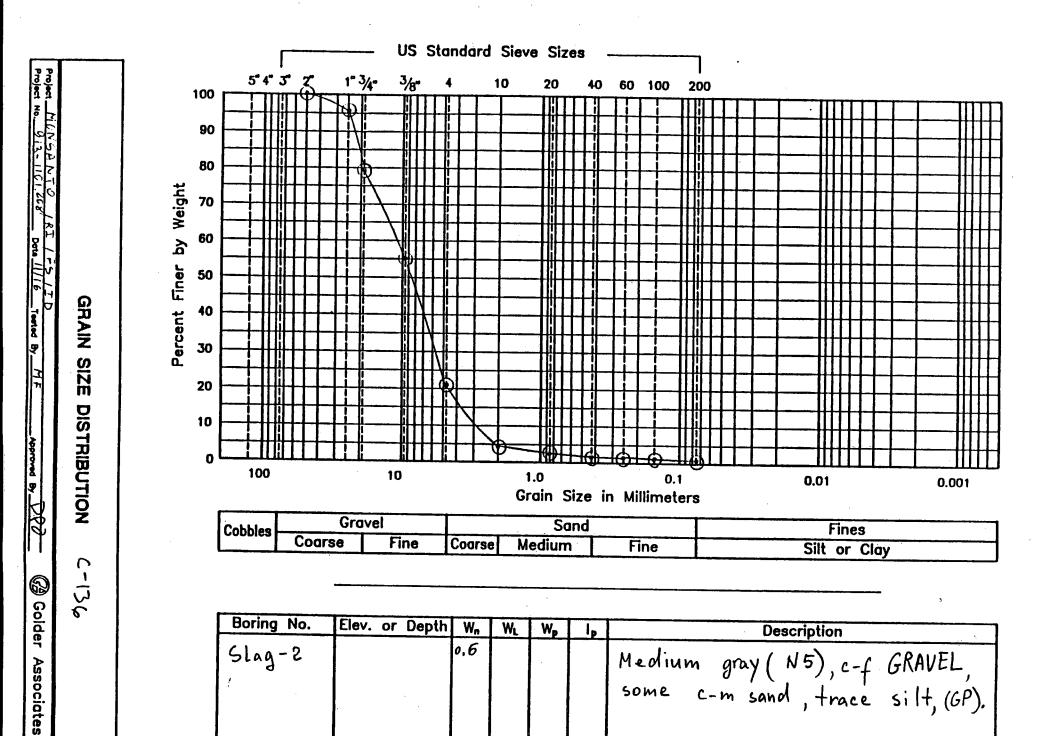
Boring No.	Elev. or Depth	Wn	WL	Wp	l _p	Description
Slurry-2		21.5				Dark gray (N3), f SAND and SILT, (SM).

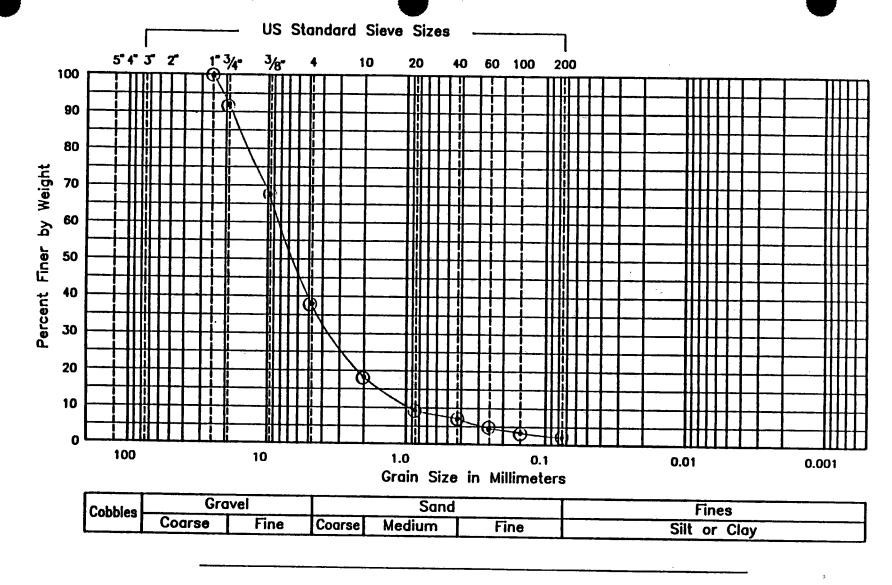


Boring No.	Elev. or Depth	Wn	WL	Wp	l _p	Description
SLURRY-3	·	30.0		,	,	Grayish black (2,N2) CLAYEY SILT, Some f Sand, trace f- graves (CL)

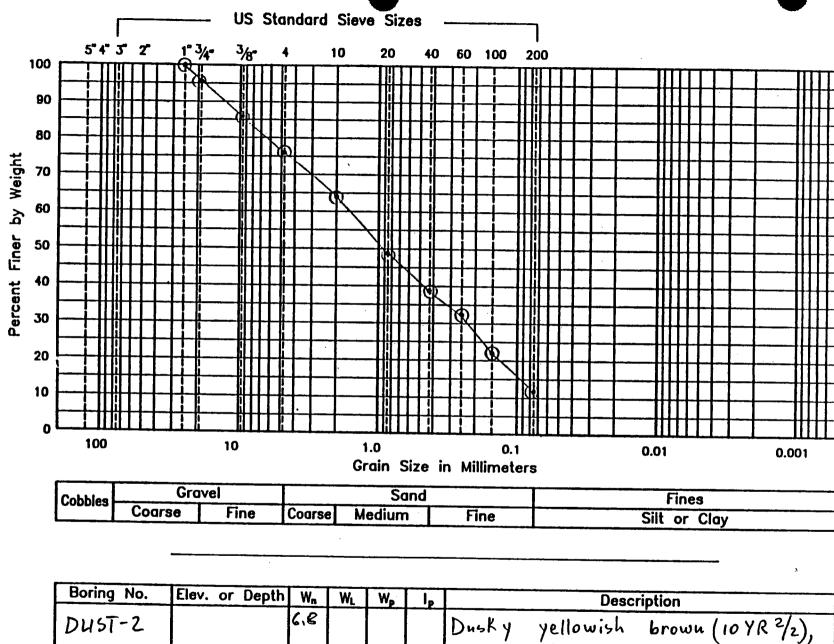
US Standard Sieve Sizes 5"4" 3" 2" 60 100 200 100 90 80 by Weight 70 60 Percent Finer **50** GRAIN SIZE 40 30 20 DISTRIBUTION 10 100 10 1.0 0.01 0.001 Grain Size in Millimeters Gravel Sand Fines Cobbles Coarse **Fine** Coarse Medium Fine Silt or Clay C-136 Boring No. Elev. or Depth W_n WL $W_{\mathbf{p}}$ Description Medium gray (N5), c-fGRAVEL and c-f SAND, trace silt, (GP). SLag-1 4.5

(A) Golder Associates





Boring No.	Elev. or Depth	Wn	WL	Wp	اوا	Description
SLAG-3		3.8			•	Dark gray (N3), c-f GRAVEL and c-f SAND, trace silt, (GW).



GRAIN

SIZE

DISTRIBUTION

136

(為) Golder

Associates

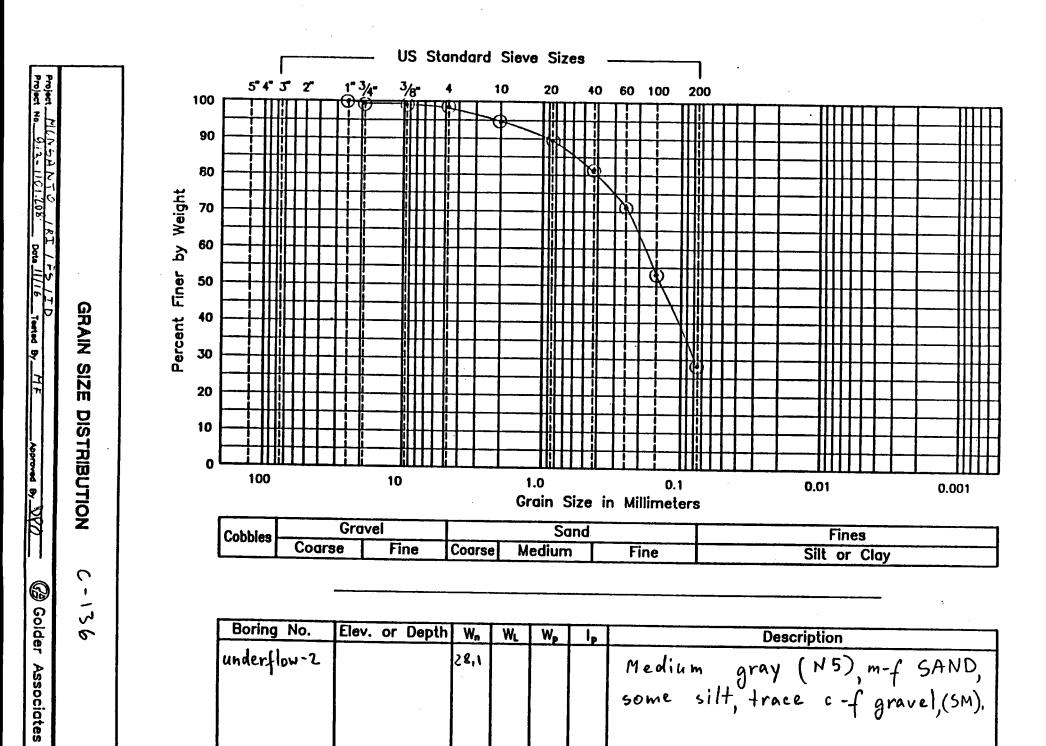
Boring No.	Elev. or Depth	Wn	WL	Wp	Ιp	Description
DusT-2		6.8				Dusky yellowish brown (10 YR 2/2), c-f SAND, some c-f gravel, li Hle silt, (SP-SM).

US Standard Sieve Sizes 5"4" 3" 2" 60 100 200 100 90 80 by Weight 70 60 Percent Finer 50 **GRAIN SIZE** 30 20 DISTRIBUTION 10 100 10 1.0 0.01 0.001 Grain Size in Millimeters Gravel Sand Fines Cobbles Coarse Fine Medium Coarse Fine Silt or Clay 0 (2) Colder ū Boring No. Elev. or Depth Wn WL Description Dark yellowish brown (10R4/2), c-f SAND some silt, some c-f gravel, (SM). 17.0 Dust - 3 Associates

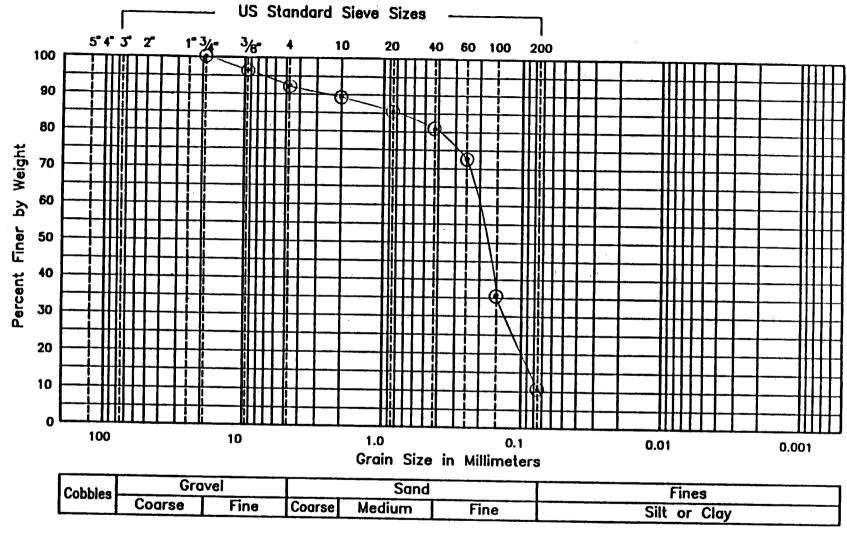
US Standard Sieve Sizes 5"4" 3" 2" 3/8" 20 60 100 200 100 90 80 Percent Finer by Weight 70 60 50 GRAIN 40 **30** SIZE 20 DISTRIBUTION 10 0 100 10 1.0 0.1 Grain Size in Millimeters Gravel Sand Cobbles Coarse Fine Coarse Medium Fine C-136 @ Golder Associates

0.01 0.001 Fines Silt or Clay

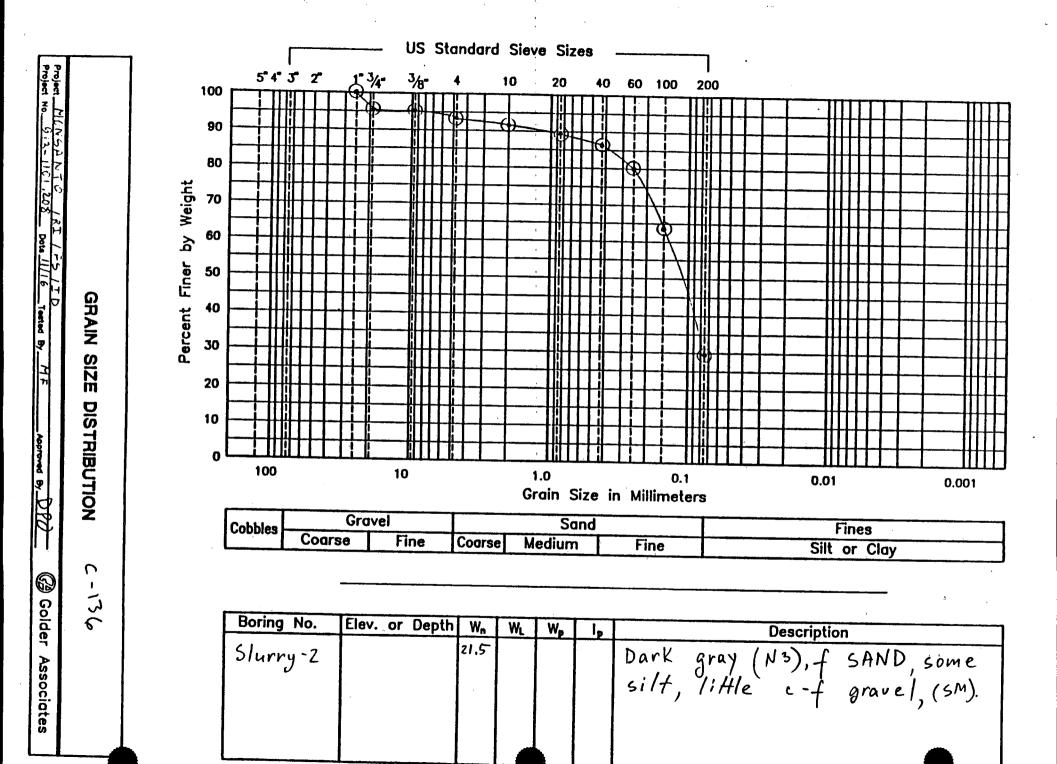
Boring No.	Elev. or De	epth Wn	WL	Wp	l _p	Description
LIN DERFLOW-1		19, 9				Light olive gray (54%), m-f SAND, some silt, trace c-f gravel, (SM).

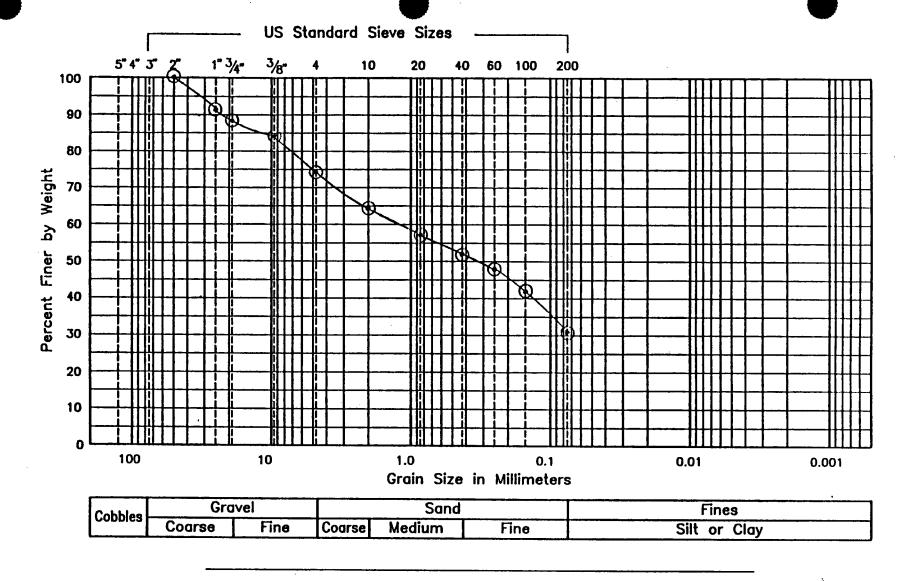


Percent Finer GRAIN SIZE DISTRIBUTION Approved By 100 0 <u>-17</u> Golder **Associates**



Boring No.	Elev. or Depth	Wn	WL	W _P	l _P	Description
SLURRY -1		18.7	j	;		Olive gray (54 4/1) m-1 SAND
						Olive gray (54 %), m-f SAND, little f gravel, little silt, (SP-SM
				:		, , , , , , , , , , , , , , , , , , ,
		1		:		· A · y





Boring No.	Elev. or Depth	Wn	WL	W _P	I _p	Description
Slurry-3		30,0				Grayish black (N2), c-f SAND and CLAYEY SILT, some c-f gravel, (SM).

GOLDER ASSOCIATES INC., REDMOND, WA MOISTURE CONTENT CALCULATION SHEET Y D-2216

PROJECT: MONSANTO/RI/FS/ID PROJ. NO: 913-1101.208

DATE:

11/16/91

TECH: REVIEW:

SAMPLE NO	WET WT.	DRY WT.	TARE WT.	TARE HO.	MOISTURE ;
SLAG-1	783.43	755.35	132.66	S-6	4.5
SLAG-2	710.20	706.35	107.28	R	0.6 ;
SLAG-3	531.05	516.45	133.18	S-2	3.8
DUST-1	891.20	889.10	160.18	E	0.3
DDST-2	874.70	829.70	167.54	RR	6.8
DUST-3	705.79	625.52	152.42	SA	17.0
UNDERFLOW-1	682.58	594.24	135.98	S-9	19.3
UNDERFLOW-2	912.00	747.09	159.95	AZ	28.1
UNDERFLOW-3	608.96	494.77	107.20	J	29.5
SLORRY-1	848.00	730.58	102.87	H-2	18.7
SLORRY-2	818.50	701.79	158.36	В	21.5
SLURRY-3	557.01	453.43	107.63	Ÿ	30.0

Pycnometer number	10208
Temperature at weighings (^O C)	19.7°C 67,4° f
Weight flask + soil + water (W _b)	701.47
Weight flask + water (Wa)	652,00
(Wa - Wb)	-42.57
Evaporating dish number	
Weight dish + dry soil	171,23
Weight dish	103.94
Weight dry soil (W ₀)	67.29
Temperature factor (K)	1,0001

GS/control temperature =
$$\frac{W_0}{W_0 + (W_2 - W_0)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \cdot K = \frac{67.29}{24.72} \times 1.0001 = 2.72$$

Comments:

Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 5 5 11 G1 2 G2 Date 11 G1 12 G

seted By __ ~ _ Approved By __D(O



SAMPLE Slag-2

Pycnometer number	10208		
Temperature at weighings (^O C)	66.24 19°C		
Weight flask + soil + water (W _b)	698.06		
Weight flask + water (Wa)	658 97		
(Wa - Wb)	-39.1		
Evaporating dish number	25	·	
Weight dish + dry soil	165.98		
Weight dish	105.61:		
Weight dry soil (Wo)	60.37		
Temperature factor (K)	1.0002		

Gs/control temperature =
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_0 \cdot W_0)} \cdot K = \frac{2.84}{}$$

Comments:

Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Proped No. 913-11 C1. 208 Date 11 1 L D1 Tested By 877 Approved By 000



SAMPLE Slag -3

Pycnometer number	60208	
Temperature at weighings (^O C)	20,3° C 6 \$.6° F	
Weight flask + soil + water (W _b)	699.87	
Weight flask + water (Wa)	658,83	
(Wa - Wb)	-41.04	
Evaporating dish number	10	
Weight dish + dry soil	178,41	
Weight dish	113.05	
Weight dry soil (Wo)	65.35	
Temperature factor (K)	0.4999	

Gs/control temperature =
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{0})} \cdot K = \frac{65.35}{24.31} \times 0.9999 = \frac{2.69}{24.31}$$

Comments:

Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 212 121 122 Date 12 7/21 Tested By M.E. Approved By DVO @ Golder Associates

SAMPLE Dust-1

Pycnometer number	10 208	
Temperature at weighings (^O C)	19.1°C 66,4°F	
Weight flask + soil + water (W _b)	699,54	
Weight flask + water (Wa)	658.96	
(Wa - Wb)	658.96 -40.58	
Evaporating dish number	25	
Weight dish + dry soil	170.93	
Weight dish	105,69	
Weight dry soil (Wo)	65,24	
Temperature factor (K)	1.0002	

Gs/control temperature =
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_a - W_b)} \cdot K = \frac{65.24}{24.66} \times 1.0002 = 2.65$$

Comments:

Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

SAMPLE Dust-2

Pycnometer number	10208	
Temperature at weighings (^O C)	12.8°C 67.6°F	
Weight flask + soil + water (W _b)	699.93	
Weight flask + water (Wa)	658.89	
(Wa - Wb)	-41.04	
Evaporating dish number	A	
Weight dish + dry soil	159.06	
Weight dish	92.27	
Weight dry soil (Wo)	66.79	
Temperature factor (K)	1,0000	

Gs/control temperature =
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_{0}}{W_{0} + (W_{a} - W_{0})} \cdot \kappa = \frac{66.79}{25.75} \times 1.0000 = \frac{2.59}{25.75}$$

Comments:

Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Tested By MF



(2) Golder Associates

SAMPLE Dust-3

Pycnometer number	L0208
Temperature at weighings (OC)	21,2 C° 70.2 F°
Weight flask + soil + water (W _b)	701.20
Weight flask + water (Wa)	658.74
(Wa - Wb)	-42,46
Evaporating dish number	4
Weight dish + dry soil	169.66
Weight dish	101.71
Weight dry soil (Wo)	67.95
Temperature factor (K)	0,9938

Gg/control temperature =
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_a - W_0)} \cdot K = \frac{67.95}{25.43} \times 0.9998 = \frac{2.67}{25.43}$$

Comments:

Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854



SAMPLE Underflow-1

Pycnometer number	L0208	
Temperature at weighings (^O C)	19.7° C° 67.4° F	
Weight flask + soil + water (Wb)	700,94	
Weight flask + water (Wa)	658.90	
(Wa - Wb)	-42.04	
Evaporating dish number	2.5	
Weight dish + dry soil	166,83	
Weight dish	101,71	
Weight dry soil (Wo)	65.12	
Temperature factor (K)	1,0001	

Gs/control temperature =
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_{0}}{W_{0} + (W_{a} - W_{0})} \cdot K = \frac{65.12}{23.08} \times 1.0001 = 2.60$$

Comments:

Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 2172 51 4 52 Date 11/11 01 Tested By MIS Approved By DVO @ Golder Associates

SAMPLE Under Slow - 2

Pycnometer number	L0208	
Temperature at weighings (^O C)	20.3 c° 68.6 F°	
Weight flask + soil + water (W _b)	701,02	
Weight flask + water (Wa)	658.83	
(Wa - Wb)	-42.49	
Evaporating dish number	BLK	
Weight dish + dry soil	173,54	
Weight dish	107.44	
Weight dry soil (Wo)	66.1	
Temperature factor (K)	0,9999	

Gs/control temperature =
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_a - W_b)} \cdot K = \frac{66.1}{23.91} \times 0.9999 = \frac{2.76}{23.91}$$

Comments:

Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 315-11011:08 Date 11/7/31

__ Tested By _____

Approved By DYO



SAMPLE Underflow-3

Pycnometer number	10208
Temperature at weighings (OC) 65. 1°F	18.46
Weight flask + soil + water (W _b)	702.06
Weight flask + water (Wa)	658.97
(Wa - Wb)	-43.1
Evaporating dish_number	20
Weight dish + dry soil	169.09
Weight dish	101.68
Weight dry soil (Wo)	67.41
Temperature factor (K)	1.0004

Gs/control temperature =
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_0}{W_0 + (W_a \cdot W_b)} \cdot K = \frac{2.77}{}$$

Comments:

Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Proper No. 513-1151-205 Date 1116 21 Tested By BA Approved By DVO @ Golder Associates

SAMPLE Surry -1

Pycnometer number	10208	
Temperature at weighings (^O C)	20,1 C* (8,1 F	
Weight flask + soil + water (W _b)	698.69	
Weight flask + water (Wa)	658.86	
(Wa - Wb)	-39.83	
Evaporating dish number	6B	
Weight dish + dry soil	162.24	
Weight dish	96,95	
Weight dry soil (W ₀)	65.29	
Temperature factor (K)	1.0000	

Gs/control temperature =
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{0})} \cdot K = \frac{65.29}{25.46} \times 1,0000 = 2.56$$

Comments:

Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. SISTICI. 458 Date 11/7/51 Tested By MF Approved By DEO Golder Associates

SAMPLE Slurry 2

Pycnometer number	10208	
Temperature at weighings (^O C)	68.5 ±°	
Weight flask + soil + water (W _b)	693.67	
Weight flask + water (Wa)	658.84	
(Wa - Wb)	-34.83	
Evaporating dish number	18	
Weight dish + dry soil	168.81	
Weight dish	107.39	
Weight dry soil (Wo)	61,42	
Temperature factor (K)	09999	

Gs/control temperature =
$$\frac{W_0}{W_0 + (W_2 - W_0)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_a - W_0)} \cdot K = \frac{G_{1,42}}{26.59} \times 29999 = 2.31$$

Comments:

Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 9/3-1/01.202 Date 1/7/91 Tested By AF Approved By VO @ Golder Associates

CAMPLE	slurry-3
SAMPLE	

Pycnometer number	10208	
Temperature at weighings (^O C)	20.6°C 69.1°F	
Weight flask + soil + water (W _b)	69707	
Weight flask + water (Wa)	658,80	
(Wa - Wb)	-38.27	
Evaporating dish number	BLK	
Weight dish + dry soil	164,03	
Weight dish	95.21	
Weight dry soil (Wo)	68.82	
Temperature factor (K)	0.9999	

GS/control temperature =
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_a - W_0)} \cdot K = \frac{68.82}{30.55} \times 0.9999 = \frac{2.25}{20.55}$$

Comments:

Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project MCI = A N + O / K = /F5 / T D
Project No. 913 - 1101. LOS Date 11/7/91 Tested By MF Approved By DPO @ Golder Associates

GOLDER ASSOCI	IRC., REDHORD	, WA							,				
ASTH C-136 DRY SIBVE ANALYSIS					SIZE OF LARG PARTICLE #10		NINUM HASS NPLE REQUI		! ! !		·		
PROJECT HOUBER Engineer	MONSANTO/RI/ 913-1101.208 BANTON	•			#4 3/4" 1"		500g 1500g 2000g						
DATE TECHNICIAN REVIEWER	11/16/91 NF O(3		***********	••••	2 - 3 -		4000g 5000g						
BOREHOLE NOMBER SAMPLE NOMBER DEPTH (ft)	SLAG-1	‡ ‡ ‡	SUAG-2	‡ ‡	SLAG-3	‡ ‡	DI	JST-1	‡ ‡ ‡	DUST-2	‡ ‡	DUST-3	•••••
TARE HUMBER TARE WT (g) WET WT + TARE (g)	132.66	* * *	R 107.28 710.20	* * *	S-2 133.18 531.05	* * *		E 160.18 891.20	* * *	RR 167.54 874.70	;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;	3A 152.42 705.79	*******
DRY WY + TARE (g) : MOISTURE (%)	755.35 k 4.5%	:::::::::::::::::::::::::::::::::::::::	706.35 0.6%	‡ †	516.45 3.8%	‡. ‡		889.10 0.3%	‡ ‡	829.70 6.8%	‡ ‡	625.52 17.0%	::::::
	COMPLATIVE WEIGHT (g)	PERCENT * FINER *	CONOLATIVE WEIGHT (g)		CONDLATIVE WEIGHT (g)	PERCENT * FINER *		HATIVE	PERCENT * FINER *	CONOLATIVE WEIGHT (g)		CUMULATIVE WEIGHT (g)	
TARE (g)		‡ 100.0 3 ‡ 3 ⁻	107.25 107.25	100.01	133.18 3" 133.18	# 100.0 % *		160.21 160.21	* 100.0 * * 3"	167.53 167.53	‡ 100.0%‡ 3°	152.49 152.49	100.
2- 1- 3/4-	266.66	100.0X* 2" 78.5X* 1"	107.25 135.58	100.0X* 95.3X*	1 133.18	100.0X* 100.0X*	1"	160.21 160.21	100.0x* 2" 100.0x* 1"	167.53 167.53	100.0% 2° 100.0% 1°	152.49 152.49	100. 100.
3/8	231.02 385.90 469.40	74.4X# 3/4" 59.3X# 3/8" 45.9X# #4	230.91 376.98 583.70	79.4X* 3 55.0X* 3 20.5X*	/8" 257.22	92.5% 67.6% 37.2%	3/8	160.21 160.21 169.48	100.0%* 3/4" 100.0%* 3/8" 98.7%* #4	199.30 265.01 327.78	95.2X* 3/4 85.3X* 3/8 75.8X* #4	192.93	94. 91. 84.
#10 #20 #40	* 567.76 * 635.83 * 666.33	30.1% #10 19.2% #20 14.3% #40	677.11 693.87 698.42	4.9X* # 2.1X* # 1.3X* #	20 479.53	18.2%* 9.6%* 6.3%*	120	174.26 175.16 175.55	98.1X* #10 97.9X* #20 97.9X* #40	405.09 506.27 571.65	64.1X* #10 48.8X* #20 39.0X* #40	324.87	75. 63. 53.
#60 #190	\$ 688.32 \$ 717.82	10.8% \$60 6.0% \$100	700.27 701.91	1.0X* \$ 0.7X* \$	60 499.99 100 507.47	4.3X* 2.3X*	\$60 \$100	187.45 434.04	96.3X* #60 62.4X* #100	618.87 684.95	31.8% #60 21.9% #10	410.45 0 473.96	45. 32.
#200 HEETS ASTM SAMPLE		3.2X# #200 :::::::::::::::::::::::::::::::::::	703.24 ::::::::::::	0.5% # ::::::::::::::::::::::::::::::::::::		1.2%	• 200 :::::::::	781.03 :::::::	14.8X* #200	:::::::::::::::::::::::::::::::::::::::	11.14 #20	:::::::::::::::::::::::::::::::::::::::	17.
SIZE REQUIREMENT?	:::::::::::	t	HO	‡	NO	*	::::: ::	08 ::::::::	* ::::::::::::::::::::::::::::::::::::	K O	*	NO	::::::
D10 D30	1.9	* D10 * D30	3.05 6.1	* D	3.8	*	D30	N/A N/A	* D10 * D30	0.069 0.23	* D10 * D30	N/A	
D60 Cu C:	† 1.99 † 9.0 8.2	* D60 * Cu * Cz	10.3 3.4 1.2	# D #	Cu 9.0	t	Cu	R/A * R/A R/A	* D60 * Cu * Cz	1.7 24.6 0.5	* D60 * Cu * Cz	H/A	i
	:::::::::::::::::::::::::::::::::::::::	*************	::::::::::::::::::::::::::::::::::::::	::::::::::::::::::::::::::::::::::::::		:::::::::	::::::::	:::::::	*::::::::::::::::::::::::::::::::::::::	***********	***************************************	::.::::::::::::::::::::::::::::::::::::	******

ASTH C-136 DRY SIEVE ANALYSIS								SIZE OF LARGE		MPLE I	MASS OF REQUIRED					
PROJECT		ONSANTO/RI/F	S/ID					#10 #4		201 501)g	į				
PROJECT NUMBER ENGINEER	9	13-1101.208 BANTON					į	3/4 ⁻ 1 ⁻		1500 2000	_	į Į	•			
DATE		11/16/91					1	· 2·		4001						
TECHNICIAN		MF					į	3-		500	-	İ				
REVIEWER	-	_DPO_														
DODGHOLG NURDED	• #	HDERFLOW-1	***********	:::::	UNDERPLON-2	::::::::::: :	:::::	SLURRY-1	::::::::::::::::::::::::::::::::::::::	:::::	SLURRY-2	::::::	::::	:::::	SLURRY-3	::::::::::::::::::::::::::::::::::::::
BOREHOLE NUMBER SAMPLE NUMBER	*	UNPULDAM-T			7-406333604	1		SHAW1-1			OUVERT &		ŧ		ODANII 4	
DEPTH (ft)	*								*				*			ŧ
:::::::::::::::::::::::::::::::::::::::	:::	::::::::::::::	:::::::::	::::	:::::::::::::::::::::::::::::::::::::::	::::::::	:::::	:::::::::::::::::::::::::::::::::::::::	:::::::::	:::::		::::::	::::	:::::	:::::::::::::::::::::::::::::::::::::::	:::::::::
TARE NUMBER	‡	S-9			17	*		N-2	•		В				Y	*
10,	‡	135.98			159.95	*		102.87			158.36		1		107.63	
WET WT + TARE (g)		682.58			912.00			848.00			818.50	:			557.01	
DRY WT + TARE (g)	*	594.24	*		747.09 28.1%	₽. •		730.58 18.7%			701.79 21.5%		•		453.43 30.0%	•
BOISTURE (X)	•	19.3%	• • • • • • • • • • • • • • • • • • • •	::::	40.14 :::::::::::::::	• ::::::::::	:::::	10.14	• • • • • • • • • • • • • • • • • • • •	:::::		::::::	::::	:::::	:::::::::::::::::::::::::::::::::::::::	::::::::::
		CUMULATIVE WEIGHT (g)	PERCENT * FINER *		COMOLATIVE WEIGHT (g)			CONOLATIVE WEIGHT (g)			COMULATIVE WEIGHT (g)	PERCEN Finer			COMOLATIVE WEIGHT (g)	PERCENT :
TARE (g)	 t	136.15			159.94	*		102.91	*		158.37		*		107.67	1
3"	1	136.15	100.0%	3"	159.94	100.01		102.91	100.01	3.	158.37	100.	0%*	3-	107.67	100.01
2"		136.15	100.01		159.94	100.0%	2-	102.91	100.0%		158.37	100.			107.67	100.03
1.	*	136.15	100.01	1"	159.94	100.0%		102.91	100.0%		158.37	100.			138.47	91.131
3/4"	\$	144.68	98.1%		164.9	99.21		102.91	100.0%		183.27			3/4"	146.89	88.731
3/8"	*	144.68	98.1%			98.9%		124.8	96.5%		184.16			3/8"	160.26	84.8%
14	*	145.75	97.9%		170.59	98.231		148.36	92.8%		193.25			#4	196.24 229.39	74.4X1 64.8X1
\$10 #20	1		94.51*		189.67	94.931		169.83 195.22	89.3% 85.3%		205.96 216.36			#10 #20	255.86	57.1%
#20 #40	*	196.35 216.09	86.9% 82.6%		221.97 267.19	89.434 81.734		223.11	80.9%		234.19			140	273.98	51.9%
\$ 60	*	265.40	71.83*		334.44	70.331		275.18	72.6%		267.19			#60	287.95	47.93
#100	-	358.90	51.4%			52.8%			35.9%		355.16			#100	308.19	42.03
1200		470.71	27.0%			28.43			10.9%		541.91	29	. 47#	\$200	348.22	30.4%
:::::::::::::::::::::::::::::::::::::::	::	::::::::::	:::::::::	:::::	:::::::::::::::::::::::::::::::::::::::	:::::::::	:::::	:::::::::::::::::::::::::::::::::::::::	:::::::::	:::::		::::::	::::	:::::	:::::::::::::::::::::::::::::::::::::::	::::::::::
MEETS ASTM SAMPLE SIZE REQUIREMENTS		НО	1		NO	: :	t t	NO	1		NO		*		NO	1
:::::::::::::::::::::::::::::::::::::::	::	************	::::::::::	:::::		::::::::::	:::::		::::::::		11/1	::::::	::::	1111111		
DIO		·		D10	R/A		D10	0.074		D10	N/A			D10	H/A	
D30	7.	, -		D30	N/A		D30	0.13		D30 Den	H/A H/A			D30 D60	H/A H/A	•
D60	1	N/A N/A		D60 Ca	N/A N/A		D60 Cu	0.2		D60 Ca	N/A N/A			Cu	N/A	
		R / F		1.13	n/A				_ *	υu	u / A		•	v w	11/14	

-WORKSHEET FOR HOLSTURE C										COARSE FRACTICA	
ASTN D-2216	Autus of sorms		* * * * * * * * * * * * * * * * * * * *	IDIADO DATA	IVES CONISH.	**************************************	IND IDOVIES		•	JARDA PRACITOR	- azulgiuz -
WORKSHEET FOR SIEVE AND			STARE S:	BATURAL BOIST : . (g):	5-6	STARE #:		5	*TARE #:	FL	1
: ASTH D-422 (HOD]	FIED FOR TEMPERAT	TUPE CHANGE)	*TARE (g):	:	132.66	*7ARE (g):	,	24.98	8 *TARE (#):	83 42	2 :
-WORLSHEET FOR DRY PREPAR	ATION OF SOILS		*HOIST WY.	. (g):	783.43	*HOIST WT.	(g):	119.10) *MOIST WI.	(g): 644.29	; ;
ASTE D-421			*OAEM DRA	WT (g):	755.35	*OVEN DRY	NT (g):	118.79	FOREH DRY 1	AT (g): 643.81	
UPDATED 3/20/90 B	/ D. OSTER	***********	*#1:		4.5]7	, 2 H X :		0.33	/\$* X \$:	0.09	<i>j</i>
PART B: SEPARATION OF FRA		/111111111111111						/#1111111	.** *** *****	/#####################################	
-PARI BEDBEBBBBBB OF THE	\I1089		*PART 8: 5	SIEVE OF COAS				********	*********	*******	11111111
WEIGHT TOTAL SAMPLE + TA	RE. AIR DRY (g):	944.20		CONOLATIVE	PERCENT		FIRAL RESULT		SIZE OF		EASS OF 2
WEIGHT OF AIR DRY TABLE (g):	194.86		WEIGHT (g)	PINER	#SIZE	PERCENT FIRE	R	* LARGEST	+\$10 PO	
REIGHT OF -\$10 TARE (g):	-	194.78	\$			- \$			PARTICLY	E REQUIRE	
WEIGHT OF -BIO FRACTION .	TARE (g):	382.57	*TARE (g)	207.80		3.	100.0%		1	-	1
WEIGHT OF -#10 FRACTION,		187.79	3.			2* 2*	100.01		3.	5000g	7
REIGHT OF 4810 PRACTOR, A		561.55	2 2 1 2 3/4	207.80	100.01	3: 1°	96.2%		2.	4000g	:
OVER DRY WEIGHT OF FIRES		187.17	* 1	235.92	96.21	,\$ 3/4°	85.0%		: 1.	2000g	:
OVER DRY WEIGHT OF COARSI		561.U/	* 3/4° * 3/8°	319.86 478.02	85.0% 63.9%	,\$ 3/6 *4				1000g	1
THE DEL METCH OF TOTAL				478.02 627.82	63.9X 43.9X	%: \$4 %: \$10	43.9% 26.5%		2 3/8°	500g	
PART F: HYDROMETER TEST (# #1D	757.77	76.57	\$2 \$20	26.51 19.61		-	B REQUIREMENT?	T NO T
. BHI E. MINHAMOND TOTAL	O CANA ADDRESS.		* PAN	765.53	26.5% 25.5%	\$ \$40	15.2%			######################################	*
SYDROMETER TYPE:	152-B		120		20.54		11.9%		1	*********	1
EYDRONETER HOMBER:	15-1515		-				7.0%		* D10:	0.20	1
BEALER HOMBER:	0-3		*PART G: S	JIEVE OR FINE	£ PRACTION		3.9%		* D30:	2.50	*
FLASE ROBBER:	8		1		:	2 0.0492	3.2%		* D60:	8.40	1
SPF GRAVITY:	2.72			*******	PERCERT		2.5%			42.00	
	-\$10					* 0.0178				3.72	
10IST WI. OF SOIL (g):	93.42				,	* 0.0113	1.91		1		1
CORRECTED DRY WY (g):	93.11		*TARE (g)	94.93	74.13 57.53	* 0.0055	1.6%			***********	*********
Rm: STARDARD SOLUTION	1.00		* \$20 * \$40	119.04	74.13	100000	1.2%		1	HOTES:	1
JEBO CORRECTION			* \$40 * \$60	134.54 146.24	57.5% 44.9%	4 0.0023			<u>:</u>		
JEBU CUBRECITUR			* \$100	146.24 163.58	44.9¥ 26.3¥		1.0%		:		 ;
TEMP. READ.	1.00		* \$200	174.36	26.324 14.73				;		
19.60 5.00							***********	4 2222 4	*********	***********	*********
26.60 3.00	ELAPSED		ZERO	CORR.	CORR.		RFF. CON				1
	TIME	TEMP. HTDBO	CORR.	PACTOR	PACTOR	* FINER		(T&Gs)	DIAH.	LOG	TTOTAL :
ER B S	(Bin.)	(C) READING	(CONTROL)		a		L, ca	I	(88)	DIAH.	
a a 6	* A AA	***************************************				*******					1
8 9 0 R 9 1	0 ***** 0.00	99 0 15	2 4 05	. 410	A 00	15 61	- 40 594		* 4400		1
8 9 3	0 ***** 1.00 0 ***** 3.00	22.9 15.0 22.9 12.5			0.99	12.0%		0.01332		-1.31	
	0 ***** 8.00	22.9 12.5 22.8 11.5			0.99 0.99	9.41 8.31		0.01332		-1.54	
	0 ***** 20.00	22.7 10.5			0.99	7.2%		0.01332 0.01332		-1.75 -1.95	
	0 ***** 60.00	22.7 9.5			0.99	6.1%		0.01332		-1.95 -2.18	1.6%
	0 ***** 191.00	22.8 8.0			0.99	4.6%		0.01332		-2.43	1.22*
8 17 4	0 ***** 484.00	22.6 8.0			0.99	4.5%		0.01332		-2.63	1.24
	0 *****1443.00	22.4 7.5			0.99	3.91		0.01332		-2.87	1.012
•											:
111111111111111111111111111111111111111		***************************************	/#####################################	*****	.**********	122222222	**********				/1111111111111111111111111111111111111
	ELRTO/EI/FS/ID			***					GOLDER ASSOC		
	1101		TASI:	208	DATE: SOO	11/13/91				L TESTING LABOR	
CCERICIAN: BE			BEVIEWED B						REDHOND, WAS	SEINGTOR	1
	**************	************	,111111111111	/#####################################	**********	/222244444	***********	\ !!!!!!	111111111111	/***********	*********

COLDER ASSOCIATES INC., REDMOND, WA

ASTN D-1140/C-136 WASH SIEVE ANALYSIS

PROJECT	H	ON	SŁN	T 0	/{	1	/[S	ľ	I)				
PROJECT NUMBER			-11						•						
ENGINEER			BAN												
DATE		1	1/1		9 1	l									
TECHNICIAN			F		_)										
REVIEWER	-		30												
BOREHOLE NUMBER	*		SLA			•	: :	•	•	•	• •	٠	•	: : 1	
SAMPLE NUMBER	ì	•	000	ŭ	•									*	
DEPTH (ft)	ŧ													ŧ	į
:::::::::::::::::::::::::::::::::::::::	:::	::	:::	::	: :	::	::	:	:	:	::	:	:	::	
TARE NUMBER	‡		Y											1	
TARE WY (g)	‡.			07										1	
HET HT + TARE (g)			10											1	
DRY WT + TARE (g)	*		10											1	
MOISTURE (%)				-	•	01						•			
	•		MOP										Ī		
			IGH					•			H			*	ţ
					-			. -	-	-		-			
TARE (g)	ŧ.		1	07	.1	65								1	t
3-	‡		1	07	۱.	65								11	
3 - 2 -	‡ ‡		1	07 07).	6 5 6 5				1	0[).	0	ļ	Ì.
3° 2° 1°	‡ ‡		1 1 1	07 07 40	.(65 65 15				1	0 (9 E). ;.	0° 5°	; i	ļ. 1
3 ⁻ 2 ⁻ 1 ⁻ 3/4 ⁻	1 1 1		1 1 1 2	07 07 40 90	. (65 65 15 37				1	0 (9 6 8 (). ;.).	0: 5: 4:	X 1 X 1	ļ.
3. 2. 1. 3/4. 3/8.	* * * * *		1 1 1 2 6	07 07 40 90		65 65 15 37 92				1	0 (9 6 8 (3 7). ;.).	0: 5: 4:	11 11 11 11	
3- 2- 1- 3/4- 3/8- \$4	1 1 1		1 1 1 2 6	07 07 40 90 94		65 65 15 37 92 20				1	00 96 80 37).).].	0: 5: 4: 0: 1:	***	
3- 2- 1- 3/4- 3/8- \$4	* * * * * *		1 1 1 2 6 9	07 07 40 90		65 65 15 37 92 40	. !			1	00 96 80 37). ;; ;;	0: 5: 4: 0: 1: 2:	11 11 11 11	
3° 2° 1° 3/4° 3/8° \$4 \$10	* * * * * * *		1 1 1 2 6 9 10	07 07 40 90 94		65 65 15 37 92 40 90	!			1	00 96 80 37). ;; ;; ;;	0:5:4:0:1:2:2:2:	3	
3- 2- 1- 3/4- 3/8- #4 #10 #20	* * * * * * * *		1 1 1 2 6 9 10 10	07 07 40 90 94 18 128 33		65 65 15 37 92 40 90 80	: ! !			1	0 (9 6 8 (3 7 1 3). (). (). ().	0 5 4 0 1 2 2 7 5	*******	
3- 2- 1- 3/4- 3/8- \$4 \$10 \$20 \$40 \$60 \$100	* * * * * * * * *		1 1 1 2 6 9 1 0 1 0 1 0 1 0	07 07 40 90 94 18 128 133		65 65 15 37 92 40 90 40	: ! !			1	0 (9 6 8 (3 7 1 3 1 3 ()		0 5 4 0 1 2 2 7 5 3	********	
3- 2- 1- 3/4- 3/8- #4 #10 #60 #100	********		1 1 1 2 6 9 1 0 1 0 1 0 1 0 1 0	07 07 40 90 94 18 128 33 33 33 33 33		65 65 15 37 92 40 90 40 60	: ! ! !			1	0 (9 (8 (3 7 (1 3 (6 (6 (6 (6 (6 (6 (6 (6 (6 (6		0 5 4 0 1 2 2 7 5 3 2	*********	
3°2°1°3/4°3/4°3/8°44°3/8°44°320°340°320°3200°3200°3200°3200°3200	**********		1 1 1 2 6 9 1 0 1 0 1 0 1 0 1 0	07 07 40 90 94 18 128 33 33 33 33 33		65 65 15 37 92 40 90 40 60	: ! ! !			1	0 (9 (8 (3 7 (1 3 (6 (6 (6 (6 (6 (6 (6 (6 (6 (6		0 5 4 0 1 2 2 7 5 3 2	********	
3°2°1°3/4°3/8°3/8°3/8°3/8°3/8°3/8°3/8°3/8°3/8°3/8	**********		1 1 1 2 6 9 10 10 10 10 10	07 07 40 90 94 18 13 13 13 13 13 13 13 13 13 13 13 13 13		65 65 15 37 92 40 90 40 60	: ! ! !			1	0 (9 (8 (3 7 (1 3 (6 (6 (6 (6 (6 (6 (6 (6 (6 (6		0 5 4 0 1 2 2 7 5 3 2	********	
3° 2° 1° 3/4° 3/8° \$4 \$10 \$20 \$40 \$60 \$100 \$200	**********	• • • • • • • • • • • • • • • • • • • •	11 11 22 66 9 10 10 10 10 10 10	07 07 40 90 94 128 33 33 33 33 33 33 33 33 33 33 33 33 33		65 65 15 37 92 40 90 84 60 11	!!!!!!!	::	•	1	0 (0 9 (0 1 (0 1 (0 1 (0 1 (0 1 (0)		0 5 4 0 1 2 2 7 5 3 2 :	********	
3° 2° 1° 3/4° 3/8° \$4 \$10 \$20 \$40 \$60 \$100 \$200 **EETS ASTH SAMPLE SIZE REQUIREMENT?	**********	• • • •	11 11 22 66 9 10 10 10 10 10 10	07 07 40 90 94 18 13 13 13 13 13 13 13 13 13 13 13 13 13		65 65 15 37 92 40 90 80 60 11		::	•	1	0 (0 9 (0 1 (0 1 (0 1 (0 1 (0 1 (0)		0 5 4 0 1 2 2 7 5 3 2 :	*********	
3° 2° 1° 3/4° 3/8° \$4 \$10 \$20 \$40 \$60 \$100 \$200	***********	• • • •	11 11 22 66 9 10 10 10 10 10 10	07 07 40 90 94 10 128 33 138 138		65 65 15 37 92 40 90 84 60 11		::	•	1	0 (0 9 (0 1 (0 1 (0 1 (0 1 (0 1 (0)		0 5 4 0 1 2 2 7 5 3 2 :	********	
3° 2° 1° 3/4° 3/8° \$4 \$10 \$20 \$40 \$60 \$100 \$200 *******************************	***********	• • • •	11 11 22 66 9 10 10 10 10 10 10	07 07 07 40 99 18 12 13 13 13 13 13 13 13 13 13 13 13 13 13		65 65 15 37 92 40 90 80 40 60 11 11 11 11 11 11 11 11 11 11 11 11 11		::	•	1	0 (0 9 (0 1 (0 1 (0 1 (0 1 (0 1 (0)		0 5 4 0 1 2 2 7 5 3 2 :	********	
3° 2° 1° 3/4° 3/8° \$4 \$10 \$20 \$40 \$60 \$100 \$200	***********	• • • •	11 11 22 66 9 10 10 10 10 10 10	07 07 07 40 99 18 12 13 13 13 13 13 13 13 13 13 13 13 13 13	3.3	65 65 15 37 92 40 90 80 60 10 10 10 10 10 10 10 10 10 10 10 10 10		::	•	1	0 (0 9 (0 1 (0 1 (0 1 (0 1 (0 1 (0)		0 1 2 2 7 5 3 2 :	**********	

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SIZE OF LARGEST	MINIMUM HASS OF	
PARTICLE	SAMPLE REQUIRED	
\$10	200g	
\$4	500g	
3/4"	1500g	
1*	2000g	
2.	4000g	
3.	5000g	

				•••••				*******	*****
OPISHEET FOR MOISTURE CONTENT OF SOILS	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			PART C: F				E FRACTION HOIS	
ASTH D-2216 **OBLSHEET FOR SIEVE AND HYDROMETER ASTH D-422 (HODIFIED FOR TEMPERATURE CHARGE)	STARE S: STARE (g):		S-2 *	TARE S: TARE (g):			*TARE 8: *TARE (g):	DU 223.68	:
CORESHELT FOR DRY PREPARATION OF SOILS	*BOIST WT.	(g):	531.05 *	BOIST WY.	(g):	99.91	*MOIST WT. (g) *OVER DRY WT (: 1264.70	:
ASTH D-421 OPDATED 3/20/90 BY D. OSTER	*OVER DRY *W1:		3.813	XX:		2.55	14X1:	0.51%	
PART B:SEPARATION OF FRACTIONS	*PART E: S		SE FRACTION:	SAMPLE:	SLAG-3				
*EIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 1394.90	t 1	COROLATIVE	PERCENT :	}	FINAL RESOLTS	******	* SIZE OF	MIRIMOR BASS	OF #
(EIGET OF AIR DRY TARE (g): 194.93 (EIGET OF -#10 TARE (g): 194.87	‡	WEIGHT (g)	FIREB	SIZE	PERCERT FIRER		LARGEST PARTICLE	+#10 PORTION REQUIRED	1
EIGHT OF -\$10 FRACTION + TARE (g): 352.68 FRIGHT OF -\$10 FRACTION, AIR DRY (g): 157.81	*TARE (g)	223.89 223.89	100.034	•	100.0% 100.0%		1 3"	5000g	. 1
GRIGHT OF +810 FRACTOR, AIR DRY (g): 1042.16	* 2°	223.89	100.03	1*	100.0%		2	4000g	:
PYEN DRY NEIGHT OF FIRES (g): 153.88 TYEN DRY NEIGHT OF COARSE FRACTION (g): 1036.85	* 1° * 3/4°	223.89 259.24	100.0% 97.0%	•	97.0% 63.1%		± 1°	2000g 1000g	:
TER DRY WEIGHT OF TOTAL SAMPLE (g): 1190.74	3/8	662.75	63.131	14	32.2%		± 3/8°	500g	1
-ART F: HTDROMETER TEST ON FINE FRACTION	*** \$4 * \$10	1031.70 1234.60	32.234 15.134		15.1¥ 9.5¥		*HEETS ASTE RE	QUIREMENT? Y	ES :
	* PAR	1294.90	10.131		6.01		***************************************	************	*******
EYDROMETER TYPE: 152E EYDROMETER HUMBER: 15-1515	*	**********	1 1111111111111		4.0% 2.1%		•	86	
BEALER ROBBER: 7	*PART G: S	SIEVE ON FINE	FRACTION		1.2% 1.3%			20 00	1 1
FLASE BOMBER: 7 SPECIAL SPECIA	i	COROLATIVE	PERCERT 4	0.0293	1.23		* Cu: 10.	47	1
7	‡ 1	WEIGHT	FIRER		1.0% 1.0%		* Cz: 2.	28	:
COPPECTED DRY WY (g): 81.33	STARE (g)	71.30	1	0.0066	0.91			######################################	******
Ra: 1.00 STARDARD SOLUTION	* \$20 * \$40	101.74 120.58	62.6% 39.4%		0.7% 0.6%		* #U	ES:	;
TERO CORRECTION	* \$60 * \$100	131.06	26.514 13.914		0.5%		<u> </u>	 	;
TEEP. BEAD.	\$ \$100 \$ \$200	141.35 146.30	7.83				1		
19.60 5.00 26.60 3.00 ELLPSED	2ERO	CORR.	CORR.	********	EFF. CON	****** Start	***********	************	***********
TIME TEMP. BYDRO 3 HR B S (min.) (C) READIR	CORR.	FACTOR	FACTOR	x finer		TåGs)	DIAH. (mm)		TAL :
8 8 49 0 ****** 0.00									1
8 8 50 0 ***** 1.00 22.8 10.			0.99			0.01332 0.01332		-1.30 -1.53	1.322
8 8 52 0 ***** 3.00 22.8 10. 8 8 57 0 ***** 8.00 22.8 9.			0.99 0.99	1.7 6.5		0.01332 0.01332		-1.53 -1.74	1.011
8 9 9 0 ****** 20.00 22.8 9.			0.99 0.99	6.5 5.8		0.01332 0.01332		-1.94 -2.18	1.02x 0.92x
8 9 49 0 ****** 60.00 22.7 8. 8 12 10 0 ****** 201.00 22.8 7.			0.99	4.7	14.901	0.01332	0.0036	-2.44	0.72:
8 17 2 0 ****** 493.00 22.6 7. 9 9 1 0 ******1452.00 22.4 6.			0.99 0.99	4.0 3.3		0.01332 0.01332		-2.63 -2.87	0.61: 0.51:
:::::::::::::::::::::::::::::::::::::::									:
POJECT: HORSANTO/RI/FS/ID							GOLDER ASSOCIA	TES IRC.	1
FEOJECT ROMBER: 913-1101 TECERICIAR: MF	TASE: REVIEWED	208 BY:	DATE:	11/13/91			BIDEORD, WASEL		1
	********	**********		********	************	******	:::::::::::::::::::::::::::::::::::::::	************	******

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HATORY	TON	BEDROND' AVEBING BEDROND' AVEBING			16/21/11	ONT:	_	EEATEKED E LV21:	********	********	******		4M 4M 13-11		: 47	ONECELE SECORDIALE
	S INC.	COPDER VESSCIVLE										1/18/078				:FE0JECT
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	-2.85	1100.0	0.01332	14,491	zI.6	1.00	07.0	11.3	0.01	7.52		[:::::		30	L	8 1
	-2.63	0.0024	0.01332	14.163	12.01	00.1	03.0	[[.]	12.0	7.22		111111		£ .	11	1 :
(1°11)	£}'Z-	7600.0	0.01332 0.01332	13.261 13.835	19.91 19.91	1.00 1.00	01.0 01.0	4.20	2.71 3.4.0	22.4		111111	-	55 33	15 10	1 2
19.2:	-1.98 -2.20	0.0063 0.0063	0.01332	12.359	70.75	1.00	03.0	62.4	23.0	22.3		111111		23	6	1 2
33.93	08.1-	0910.0	0.01332	11.539	35.25	1.00	01.0	1.20	28.0	22.4	00.8	*****		į,	6	L :
16.01	09.1-	0.0252	0.01332	611.01	12.51	00°I	04.0	11.1	33.0	22.6	00.£	*****	0	36	6	L B
52.13	ec.1-	6010.0	0.01332	101.6	21.12	1.00	01.0	11.1	0.11	3.22	00.1	******		31	6	1 1
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RAPLE	DIAN.	(TE)	ī	p'ca		ę	1	(COMINOL)	BEVDIRE	(3)	(.ais)		\$		a a	I (1:
JATOTZ	FOC	DIVR	(186s)	DEPTH	I LIBER	FACTOR	FACTOR	COEE.	BIDBO	TERP	INI					
			THATZH			CORE.	COBB.	OHIZ			LAPSED	1			3.00	\$ 76,60
: 22222222	*******	*************	********	*********		:21.07 :::::::::::::	36.721 *********	0074							2.00 8.00	* 19.60
		:				***.06	74.611	0018								***************************************
				28.8		*16.88	36.101	098 1	3							*ZEEO COB
		1		x 3.11		*#T.88	86.301	071 1						HO	EOLDTI	18VORVIS:
		SAION :		14.4%		*16.66	98.301	1 \$50			00.10			191 1	u tua a	ser: *Coebecle
*********	*******	**************************************		12.61	••••	I 1	87.301	(3) 3847			68.83 68.83					IN ISIOR:
		: CI: K\V		33.9% 28.8%		FIRER :	TEDIAN				011-		- ,			*PORTION
		4/A : UD *		16.01		PERCENT :			3		2.65				CHATIT	
	,	4/H :090 :		\$2.1%		1	•	1	;		L				RBEB:	
		1 D30: H/V		zč. 78		FRACTION :					52			- 11 d		FEVER H
		4/A :010 :		75.21 16.91	1700 120	**************************************	**********	**************************************			9191-9 1958	. \$				THEORGIH:
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ON		*REELS VOIR BEGO		12.96		*26.38	114.65	014 1								:Part F:
	_			\$6.34		*10.79	112.93		*******							
	3005	.8/8 *		20.78		\$\$7.86 ************************************	109.74	.8/C 1		73.01 66.885						COLEN DEL
	1000g 5000g	.7/£ : I :		70.001 72.89		# 1 00001	102°13	• • • •	; }	33.715	. (*)					CLEE DEL
	30001			20.00 [*20.001	105.12		•	17.01	: (BY (g	H' VIB	EBYCLO	014+ 4	O LESIEM:
	30005	2.		10.00I	_	100.0%	105.12	3.								O LESIANE
		,		10.001	•••	*	105.12	(8) IBATi	•	36.288		(A) INA				*MEICHL O
	BEGDIEED	* PARTICLE				•	(2) LEGIGE)		; •	25.TOI						*MEICHL O
	+#10 POE	* PVBCEZI * SIZE OL		EBCERL LIKE IBVE BESOFL			MAILVIOROS		•	360.44	:(8) [VIE DE	TARE,	+ ITA	VS TVIO	SKEICEL L
		*************						1	!							1
				I-T200		R LEVCLION:										sea tang:
		***************************************		*********			**********			*******	******	COLLER	######################################	888888 e/n7/e	####### LDV1PD	
1	286.0 . cc.ctt :	:MI: :OAER DEL NI (E)	162.0 62.21	:(2)	ıx. Darə dbi mi	*162'0 * AT'ERR	:(3) 1	:AZ: :OAEH DEL H.				0242V	U DA P		J-C RIS	
		*MOIST WI. (g):			OIST WI. (ROIZI KI			STIO	S IO NO	114841			IIESTEGA:
	11.201	:(3) 3371:		•	(S) HEAL	160.18 =	· •	:[8] [8]:	: (2	BE CEVEC	TASSABS	D LOB L	DILLE	g) 22	1-0 RIS	7 :
	9-N	:TARE #:	33		: 1871			: TABE 1:				EGRELER	gie de			SESTEON:
BHATATAR		\$ ####################################		UAT14071 #		\$:		entar	או ועד	tunn e		Z-C RIS	T TESTECAL
1881510H	FRACTION :	STATE DE COVERE	4907210X	T TELCTION	888888888888 878 - 3 9989	ibl Comarnati	TESTESTESTES TYPIUM JAGA	.TE	, ,,,,,,,,,,,	11111111						

TRITERING THE PART WATER OF THE PART OF SOILS	**************************************	EXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	DRE CONTENT*	********* AET C: FI	**************************************	ISTURE	*PART D: COARS	E PRACTION ES	:::::::: STORE
DEESERT FOR MOISTURE CONTENT OF SOILS ASTR D-2216	4		•				1		1
ORISHEET FOR SIEVE AND HYDROMETER	*TARE #:		RR 37	MARE #:		25 20	TARE D:	כ פת מפ	1
ASTH D-422 (HODIFIED FOR TEMPERATURE CHANGE)	*7AEE (g):	: (a):	167.54 ¥7	(AEE (g):	(a).	77 75	*1005 (g): #MOIST WT (e)	273 51	:
CORESHET FOR DRY PREPARATION OF SOILS	*UALA 1019 *UALA 1019	. (g): ¥9 (e):	829 70 ±0	DVEN DRY N	(6). T (g):	69.23	*OVER DRY WY	g): 217.77	1
ASTE D-421 OPDATED 3/2D/90 BY D. OSTER	###:	#1 (E)-	6.801*1	11:	. (6).	7.971	*#1:	3.861	1
11111111111111111111111111111111111111	**********	**********	***********	********	***********	******	***********	***********	*******
PART B:SEPARATION OF FRACTIONS	*PART E: S	SIEVE OF COAR	RSE FRACTION:	SAMPLE:	DUST-2				¥
	*				FIRAL RESULTS		* ************************************	MINIBUM MA	
FIGET TOTAL SAMPLE + TARE, AIR DRY (g): 413.41	1	WEIGHT (g)	PERCENT :		PERCENT FINER		* LARGEST	+\$10 PORTI	
FEIGHT OF AIR DRY TARE (g): 101.49 FEIGHT OF -810 TABE (g): 101.49		#\$1001 (R)			Tendent trung			REQUIRED	
EIGHT OF -BIO FRACTION + TARE (g): 258.11	*TARE (g)			3-	100.0%		1		-
FIGHT OF -810 FRACTION, AIR DRY (g): 156.62	1 3	68.94	100.03*		100.0%	·	3 *	5000g	:
ELIGET OF +\$10 FRACTOR, ALR DET (g): 155.30	2 ·		100.0%		90.21		* 2° * 1°	4000g 2000g	:
TER DRY WEIGHT OF FIRES (g): 145.05	1°	97.73	90.2%		90.2% 75.6%		* 1°	2000g 1000g	•
THE DRY HEIGHT OF COARSE FRACTION (g): 149.53	* 3/4° * 3/8°	97.73 140.95	90.2 % 75.6 %		66.6%		± 3/8	500g	
TYEN DRY WEIGHT OF TOTAL SAMPLE (g): 294.58	•	167.21	66.67		56.24		1	*****	*
ART F: HYDROMETER TEST ON FIRE FRACTION	* \$10	193.11	56.27		45.8%		*MEETS ASTE BI	EGDIBEREKI;	¥0 1
. But I. Middenting that on the shape to	* PAN	212.03	51.4%		39.2%		**********	**********	*******
SYDROMETER TYPE: 152B	*			•••	34.3%		\$ • 710 P	**	:
SYDROMETER BUMBER: 15-1515			* ************		27.1% 19.7%		* D10: R,	/ <u>k</u> /k	
ETALER BOUBER: BLI	*PART G:	SIEAR ON SIN	F PRACTION :		17.9%			/ <u>b</u> / <u>b</u>	1
FLAST-PRIBER: 4 9F GRAVITY: 2.59	1	COMOLATIVE	PERCENT *		14.13			/ <u>L</u>	1
PL TESTED: -\$10					10.7%		* Cz: K	/ L	1
HOIST WY. OF SOIL (g): 64.41	\$		FIRER *		8.8%		1		*
CORRECTED DRY MT (g): 59.65	STARE (g)			0.0065	6.9%			1111111111111 Prr	*********
R a : 1.00	\$ \$20	79.97	81.61*	0.0037	6.0% 5.5%		* NO'	TES:	1
STANDARD SOLUTION	* \$40 * \$60	87.08 92.19	69.7%* 61.2%*				;		
ZERO CORRECTION	* \$100	99.85	48.321		1.0-		1		:
TEEP. READ.	£ \$200	107.71	35.1%				t		1
19.60 5.00				*******			***********	***********	*******
26.60 3.00 ELAPSED	ZERO	COPR.	CORR.	e prurp		Start Tågs)	DIAN.	LOG I	TOTAL
	DRO COER. DIRG (CONTROL	FACTOR ,) t	FACTOR	I FIREE	L, ca	I aus;	(BB)		AMPLE :
) ER M S (min.) (C) REA							• •	•	
7 9 22 0 ***** 0.00				•	- 48 444		A 4 5 6	4 99	11 000
· · · · · · · · · · · · · · · · · · ·	22.5 4.1		1.01	31.8		0.01332 0.01332		-1.33 -1.56	17.9 2: 14.1 2:
	18.5 4.1 15.0 4.1		1.01 1.01	25.0 19.1		0.01332 0.01332		-1.76	10.721
	15.0 4.1 13.0 4.1		1.01	15.7		0.01332		-1.95	8.833
	11.0 4.1		1.01	12.3		0.01332		-2.19	6.917
	10.0 4.1		1.01	10.6	14.491	0.01332		-2.43	6.011
7 17 2 0 ***** 460.00 22.8	9.5 4.0		1.01	9.9		0.01332		-2.63	5.5%
g 7 29 0 ******1327.00 22.2	9.0 4.2	26 0.40	1.01	8.7	14.655	0.01332	0.0014	-2.85	4.9%1
	**********		***********		**********	111111		***********	
PROJECT: MONSANTO/RI/FS/ID	,						COTDER T22001	ATES INC.	3
PROJECT NUMBER: 913-1101	TASE:	208	DATE:	11/13/91				TESTING LABORA	
*reprietts. Mr	BEATEME	D BY:	<u> </u>		_	****	REDMOND, WASH		1
11:	***********	***********	**************		*************		**********		

												•	•	
IN ANTHER		11111111111111111111111111111111111111		*******		*D1D9 4. W	::::::::::::::::::::::::::::::::::::::	::::::::::::::::::::::::::::::::::::::	11111111111 + Dict	:::::::::: ::::::::::::::::::::::::::	N MATCPRO	*************** E *PART D: COA	11111111111111111111111111111111111111	HATCHARD .
ASTH D-		CONIENI OF	20172			*FARI A. B.	יפוטם עמעטום		PERRI U. F.	ing febuli	MOTOTOR W	B • FBRI D: COE	EDB FEELITUR	10151023
TRISHERT FOR		ATAKOSOFE D	R			*TARE #:		34	STARE S.		1	7 *TARE 8:	ę	:
ASTE D-	422 (BC	DIFIED FOR	TEMPERA	TORE CHAI	RGE)	*TARE (g):		152.42	*TARE (g):		24.7	5 *TARE (g):	106.95	
CRISHEST FOR		PARATION OF	SOILS			*BOIST WI.	(g):	105.19	*BUISI WI.	(g):	79.4	9 *HOIST NT. (g): 205.31	1
ASTH D-			_			*OVER DRY !	iī (g):	625.52	*OVER DRY I	iī (g):	79.0	1 *OVEN DRY WI		
		BY D. OSTE				•••					0.8		0.53	
LET B:SEPARAT			*******					SE FRACTION			********	**********	********	**********
TEL DIDEFEREI	INR OF I	18211089				*IALI B: D:	IBVB UI CUAI				******	**********	********	**********
HISET TOTAL S	FALLE +	TARE, AIR D	RT (g):	496.70		· ·	COMOLATIVE	PERCENT		FINAL BEST		* 512E OF		EASS OF :
light of AIR				207.90			WEIGHT (g)			PERCENT FI		* LARGEST	+\$10 PO	
IIGHT OF -\$10				207.85								* PARTICLE	BEQUIRE	D :
FIGET OF -\$10						STARE (g)	106.83		3 °	100.03		1		1
FIGHT OF -\$10				189.95		3 .	106.83	100.02		100.03		3 3.	5000g	1
IGET OF +\$10 ER DRY WEIGE			g }:	98.85 188.28		t 2 ⁻	106.83 106.83	100.02		100.03		2 2	4000g	1
IN DRY WEIGH			W (a).			± 3/4°	106.83	100.0% 100.0%	•	100.03 92.43		* 1°	2000g	
IN DRY WEIGH						* 3/8	128.54	92.47		86.13		* 3/4 * 3/8	1000g 500g	1
111111111111					******		146.61	86.17		78.23		\$	2008	
RT F: HYDROR	ETER TES	T OR FIRE F	BACTION			* \$10	169.18	78.21		71.9%		*HEETS ASTE	REQUIREMENT?	#O #
						* PAR	188.90	71.4%	: \$40	58.1%		*********	-	
DROBLIER TYP			152B			1			1 160	62.13		1		
DROBLIER HOW	BER:	:						*********		50.32			R/A	
TIER BOMBER:			22 8				EAE ON LINE	FRACTION		34.9%			R/A	
ASI BOEBER:	٧.					: :	COMPLIATION	PERCENT	0.0441	28.23			N/A	
B ESTED			-#10				MEIGHT		* 0.0265 * 0.0168	22.6 3 17. 53			R/A R/A	
Is OF S			76.97					11000		15.4%		1	n/ <u>a</u>	
REECTED DRY			76.30			*TARE (g)	77.17		a 0 0063	12.9%		*********		
:			1.00			1 120	83.39	91.81	* 0.0039	10.9%		* R	OTES:	1
ARDARD SOLDT						# \$40	87.03	87.1%	0.0024	9.5%		*		1
130 CORRECTION	l					* 160	92.95	79.31		8.01		1		t
						* \$100	104.39	64.32				1		1
TMP. READ. 3.60 5.00						2 \$200	119.42	44.63				<u>*</u>		*
5.60 3.00 5.60 3.00		1	ELAPSED			ZERO	CORR.	COBR.	• • • • • • • • • • • • • • • • • • • •		CORSTANT	***********		
7.00			TIME	TEMP.	HTDRO	CORR.	FACTOR	FACTOR	I FIRER	DEPTE	(TåGs)	DIAB.	LOG	ATOTAL :
ER 1	i S		(min.)	(C)	READING		t	a	7 121102	L,cm	I	(an)	DIAM.	SAMPLE :
							•						•••••	
11 9	57	0 *****	0.00			_								t
11 9	58	0 *****	1.00	22.1	31.5	4.29	0.40	1.00	36.07		0.01332		-1.36	28.23
11 10 11 10	0	0 *****	3.00	22.1	26.0	4.29	0.40	1.00	28.93		0.01332		-1.58	22.6%
11 10 11 10	5 17	0 *****	8.00	22.1 22.1	21.0	4.29	0.40	1.00	22.34		0.01332		-1.78	17.5%
11 10	57	0 ::::::		22.1	19.0 16.5	4.29 4.26	0.40 0.40	1.00 1.00	19.7% 16.5%		0.01332 0.01332		-1.97 -2.20	15.42
11 12	34	0 *****		22.4	14.5	4.20	0.40	1.00	14.0%	13.753	0.01332		-2.20 -2.40	12.9% 10.9%
11 16	58	0 22222		22.6	13.0	4.14	0.40	1.00	12.13		0.01332		-2.61	9.5%
12 8	28	0 2222223		21.9	12.0	4.34	0.20	1.00	10.3%		0.01348		-2.86	8.0%*
														1
:111111111111111				*******	*******	********	******	********	*******	********	******	**********		*********
JICT:		DRSARTO/RI/F	S/ID			B167	000	D. BC	44			GOLDER ASSOCI		1
BUECT RUBBED: BERICIAR:	3	13-1101 BF				TASE: REVIEWED B	208 V.	DATE:	11/13/91			GEOTECHNICAL		
	1111111		1111111	11111111	11111111					********	********	EEDHORD, WASH	INSION	
1					 									

	*********	11111111	,111111111	• • • • • • • • •	.2222222	12222223	######################################	######################################	(1111111111) 	######################################	1222222222222 122222222222222222222222	######################################	12222222222 •DIDT D. CO	######################################	#U1511111
	ET FOR EOI ASTR D-221		CORTERT OF	SOILS			*PART A: BA	TURAL BUIST		*PART C: F1	.NE FEBUITUR D		*PARI D: CON	ARSE FRACTION B	401010F
*NORISHIE	ET FOR SIE	EVE AND B	HIDRORETER	ß.		1	STARE 8:			PARE 1:			STARE 8:	6	*
: 1	ASTE D-422	2 (HODIF	FIED FOR T	TEMPERATO	DEE CHARF		*7APE (g):		135.98 4	TARE (g):			*TARE (g):	90.97	*
*WORLSHE!	ET FOR DRY	/ PREPAR'	RATION OF S	OILS		1		(g):	682.58	MOIST NY.	(g):	72.54	SMOIST NT. (g): 104.73	•
: 1	ASTE D-421	1					*OVER DRY W			≠OPBN DRY W	/I (g):	68.61	*OVEN DKI WI	T (g): 104.05	
1 [DPDATED 3/	/20/90 BY	BY D. OSTER	4					19.281		**********	9.291		5.661	
********	*******	*******	*********	*****	*********	/2222227	**********	**************************************	, 8111111111 ; Walenian			/	/#####################################	************	**********
*	SEPARATION				**	1	t	SIEVE OF COARS	1	*********	***********			HININOR E	
			ERE, AIR DE	A (g):	296.22 106.75	7		CDEULATIVE WEIGHT (g)	PRECERT :		PIRAL RESULTS PERCERT PIRES		* SIZE OF * LARGEST	+\$10 POR	
	OF AIR DRY				106.75	•	, 1	. 491 1914W			TPRADUL LIND		-* PARTICLE		
Anglings /	OF -\$10 TA	PACALUB 'KF (R)-	: + TARE (g)				*TABE (g)			s 3°	100.0%		1	•	_
			AIR DRY		175.00		: 3.	91.00	100.03		100.0%		3 .	5000g	•
			AIR DRY (g		14.47		ž 2·	91.00	100.03		100.0%		2	4000g	;
	RY WEIGHT O			•	160.12		1	91.00	100.0%		100.0%		1 1°	2000g	2
			SE FRACTION				¥ 3/4°	91.00	100.02		100.0%		× 3/4°	1000g	2
FUALE DE.	L AULIAN L	OF TOTAL	L SAMPLE (g	* 16/-	173.82		* 3/8*	91.00	100.01		99.3%		* 3/8°	500g	,
11111111	1 MD1011 -	11111111	11111111111111111111111111111111111111	.,,. .11111111	41111111			92.29	99.31		95.0%		1		;
			OR FIRE FR				* \$10	99.66	95.0%		88.4%			REQUIREMENT?	
1	2100	/# • • · ·	##				* PAN	102.60	93.32	× \$40	84.8%			*******	/#####################################
•	ETER TYPE:			152B			1			\$ \$60	81.9%		t		3
	TER ROBBER		•	15-1515				*********			72.9%			B/A	2
*BEALER I		•		GOL				SIEVE OB FIRE			53.7%			B/A	1
FLAST N				3		,				* 0.0416				N/A	3
1	C GRAVITY:	:		2.60		•			PERCERT					R/A	*
than of	TESTED:			-\$10				WEIGHT		* 0.0163			t Cz:	R/A	•
*HOIST W	NT. OF SOIL			80.77									*		********
*COPPECT!	TED DRY NT			73.90			*TARE (g)			* 0.0063				:************ ROTES:	
TRE:				1.00			* #20						1 1	VOIE9:	;
	RD SOLUTION						# #40 • #60	84.27 86.56	28.88 20.38				:		 ,
*ZERO CU	RRECTION						* \$60 * \$100	86.56 93.54	85.2% 76.7%		3.44		•		
*	ORRECTION PRAD.						* \$100 * \$200	93.54 108.51	16.13 56.53				•		
							* ********	100.01	-v.v-	* *************	**********	4111111	*********		**********
* 19.60 * 26.60			,	ELAPSED			ZERO	CORR.	CORR.	******		RSTART	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		•
¥ 26.60	3.00			JINI	TEMP.	HYDRO	CORR.	FACTOR	FACTOR	I FIRER		(T&Gs)	DIAB.	LOG	TOTAL 2
	HE E	S		(Bin.)			(CONTROL)		8	• • • • • •	L,ca	I	(22)	DIAB.	SAMPLE :
**************************************		27	0 ::::::				A = = = -		-		-,				
* 8	Ř	28	0 ::::::			37.5	4.03	3 0.70	1.01	46.7	11 9.981	0.01317		-1.38	
* 0 * 8	8	30	0 222221			29.0			1.01	35.1		0.01317	0.0256	-1.59	33.32
1 8	8	35	0 333333			24.0			1.01	28.3	12.195	0.01317	0.0163	-1.79	26.8%
1 8	8	47	0 ::::::			20.5			1.01	23.0	12.769	0.01332	0.0106	-1.97	
1 8	9	27	0 *****			17.0		9 0.40	1.01	18.2	21 13.343	0.01332		-2.20	
1 8	12	8	0 *****	221.00	22.8	13.5	4.09	9 0.40	1.01	13.4	13.917	0.01332		-2.48	
3 8	16	59	0 *****	\$ 512.00	22.6	12.5	4.14	4 0.40	1.01	12.0		0.01332		-2.66	
1 9		56	0 ::::::	-1469.00	22.4	11.0	4.20	0 0.40	1.01	. 9.8	B\$ 14.327	0.01332	2 0.0013	-2.88	
1									*********	********	************	*******	************		
*PROJECT)RSARTO/EI/I		/11111111	********	,IIII	111111	*********	********	***********	*******	GOLDER ASSO	CLATES INC.	•••••
	T ROMETE:		: NSBRIO/EI/I 3-1101	19110			TASE:	208	DATE:	11/13/91	ı			AL TESTING LABO	ORATORY
**ECENIC	CIAR	×	K\$				REVIEWED	BY:	798)			REDEOND, WAS	ASBINGTON	
112000	.111111111				,111111117	411111111	1111111111	**********				.11111111	/#####################################	************	********
6	1														

		11111111111111111111111111111111111111		**************************************	ii ii ii ii ii ii ii ii ii ii ii ii ii
Character to be a control of the con	: •LVZI V: PVIANYP DATDI	UES CONIBNITIDAL C. PINS		* TARY D. CUMBON PRECITOR D	101010101
CORRECT FOR SIEVE AND HYDROMETER	*TARE #:	AZ #TARE #:		STARE S: B4	1
	TARE (g):	159.95 *TARE (g):		*TARE (g): 78.38 *BOIST NT. (g): 94.25	1 2
	*MOIST WT. (g): *OVER DBY WT (g):	912.00 *BOIST WT. (g) 747.09 *OVER DRY WT (*OVER DRY NT (g): 94.03	:
	*# * :	28.09%**%:	1.103		
. 1212 1212 1212 1212 1212 1212 1212 12	*********	***************	*************	******************	*********
	*PART E: SIEVE OF COAR.		DBBFLOW-2 ************************************	************	1
FRIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 376.88	COMULATIVE			* SIZE OF BIRINDE F	IASS OF #
EIGET OF AIR DRY TARE (g): 78.39	* WEIGHT (g)		RCERT FINER	* LARGEST +#10 PORT	
FIGET OF -\$10 TARE (g): 77.18	\$	* 3*		PARTICLE REQUIRED	1
	*TARE (g) 78.36 * 3° 78.36	* 3" 100.0%* 2"	100.0X 100.0X	* 3° 5000g	1
EIGET OF +810 FRACTOR, AIR DRY (g): 16.43	2 78.36	100.0%* 1*	100.0%	* 2" 4000g	1
TEN DRY WEIGHT OF FIRES (g): 279.00	* 1° 78.36	100.02: 3/4"	100.0%	* 1° 2000g	1
TER DRY MEIGHT OF COAPSE FRACTION (g): 16.20	3/4 78.36	100.02* 3/8*	99.6%	* 3/4" 1000g * 3/8" 500g	1
VER DRY WEIGET OF TOTAL SAMPLE (g): 295.21	3/8° 79.55 2 84 81.11	99.6%* \$4 99.1%* \$10	99.1¥ 97.2¥	* 3/8" 500g	
APT F: HYDROMETER TEST ON FIRE FRACTION	\$10 86.71	97.2% \$20		*HEETS ASTH REQUIREMENT?	RO :
	PAR 89.18	96.33* \$40	*****	*********	*********
TOROUTTER TYPE: 152H	!	* #60	88.2%	\$ han. 1871	1
ITDROMETER HUMBER: 15-1515 FEARER HUMBER: 4	PART G: SIEVE ON FINE	**********	14.67	* D10: R/A * D30: R/A	1
	\$	* 0.0433		* D60: R/A	
PECIFIC GRAVITY: 2.76	 COMPLATIVE 	PERCENT # 0.0263	37.0%	* Cu: R/A	- 1
O TESTED: -#10	# WEIGE?	FINER # 0.0167		* Cz: R/A	
Ol., A. OF SOIL (g): 60.05 OBERECTED DRY WY (g): 59.40	*TARE (g) 108.44	* 0.0107 * 0.0063	24.2¥ 19.4¥	*	*********
	* #20° 110.40	96.7% 0.0035	14.7%	* HOTES:	1
	\$40 111.79	94.47* 0.0023	14.03	1	
TERO CORRECTION	# #60 113.91	90.83* 0.0014	11.8%	<u> </u>	 ;
TEMP. READ.	* \$100 120.04 * \$200 133.09	80.5%* 58.5%*		:	<u>;</u>
	*******	********	*******	***********	********
26.50 3.00 ELAPSED	ZERO CORR.		EFF. CONSTANT	100	*
TIME TEMP. BYDBO	CORR. FACTOR		DEPTE (T&Gs) L,cm I		TTOTAL *
ER H S (min.) (C) READING	(CORTROL) t	a	1,01 B	(MA) PIDU.	
11 9 2 0 ****** 0.00					*
11 9 3 0 ****** 1.00 22.2 34.0	4.26 0.40		10.555 0.01332	0.0433 -1.36 0.0263 -1.58	48.2% 37.0%
11 9 5 0 ****** 3.00 22.2 27.0 11 9 10 0 ***** 8.00 22.2 21.5	4.26 0.40 4.26 0.40		11.703 0.01332 12.605 0.01332	0.0167 -1.78	28.222
11 9 22 0 22222 20.00 22.1 19.0	4.29 0.40		13.015 0.01332	0.0107 -1.97	24.232
11 10 2 0 ***** 60.00 22.2 16.0	4.26 0.40		13.507 0.01332	0.0063 -2.20	19.4%
11 12 30 0 ****** 208.00 22.4 13.0	4.20 0.40		13.999 0.01332	0.0035 -2.46	14.732
11 16 53 0 ****** 471.00 22.6 12.5 12 8 23 0 ******1401.00 21.9 11.5	4.14 0.40 4.34 0.20		14.081 0.01332 14.245 0.01348	0.0023 -2.64 0.0014 -2.87	14.0%* 11.8%*
					ŧ
111111111111111111111111111111111111111					
EGJECT: MONSANTG/RI/FS/ID	P1CY. 200	DATE: _ 11/13/91		GOLDER ASSOCIATES INC. GEOTECHNICAL TESTING LABOR	* PROTA
ROJECT ROMBER: 913-1101 FECHRICIAN: MF	TASE: 208 REVIEWED BY: _	DATE: 11/13/91		REDECED WASHINGTON	* 1401A
::::::::::::::::::::::::::::::::::::::	***********	111111111111111111111111111111111111111			

NEIGHT OF -810 FRACTIOR, AIR DRT (g): 321.08	,	ORRECTIO READ.	•••••					* \$100 * \$200	93.26 105.75	74.4% 56.0%				i i		;
NEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 654.71	PORTION HOIST N CORRECT Re: STANDA	N TESTED NT. OF S TED DRY BD SOLUT	: DIL (g): NT (g): ION		68.97 67.84		:	# H #TARE (g) # #20	75.89 75.89	FINER : : 100.02	0.0168 0.0107 0.0064 0.0037 0.0026	26.9% 24.0% 17.7% 15.9%		* Cz: H/ *	/ <u>}</u> ::::::::::::::::::::::::::::::::::::	; ; ; ; ;
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 654.71	b. FLASI	ADABER:	BER:	1	64 3		; ; ;	* ********** *PART G: SIE *	::::::::::::::::::::::::::::::::::::::	FBACTION :	\$60 \$100 \$200 0.0431	90.2% 73.1% 55.0% 45.2%		* D10: R/ * D30: B7 * D60: B/	/ <u>L</u> / <u>L</u>	: : :
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 654.71 CUMULATIVE PERCENT : FINAL BESULTS SIZE OF HINIMUM MASS OF WEIGHT OF AIR DRY TARE (g): 316.38 WEIGHT (g) FINEE *SIZE PERCENT FINER LARSEST +#10 PORTION PARTICLE	::::::::	******	*******	******	******		: ::::::: ::::::::::::::::::::::::::::	: \$4 : \$10	79.74 82.93	99.2 7 2 98.3 7 2	\$10 \$20	98.31 98.31		*HEETS ASTH I	REQUIREMENT?	
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 654.71	WEIGET WEIGET OVEN DE OVEN DE	OF -#10 OF +#10 RY WEIGE RY WEIGE	FRACTION FRACTOR, OF FINE OF COAR	, AIR DRY (AIR DRY (g S (g): SE FRACTION	g): ;): (g):	327.08 11.25 321.74 11.10	1 1 1	: 3° : 2° : 1° : 3/4°	77.18 77.18 77.18 77.18	100.02* 100.03* 100.03*	2° 1° 3/4° 3/8°	100.0x 100.0x 100.0x 100.0x		* 3° * 2° * 1° * 3/4°	4000g 2000g 1000g	: :
PART B:SEPARATION OF FRACTIONS *PART B: SINTE OF COARSE FRACTIONS SAMPLE: UNDERFLOW-3	MEIGHT MEIGHT MEIGHT	TOTAL 5 OF AIR : OF -#10	MPLE + T ORY TARE TARE (g)	ARE, AIR DB (g): :		316.38 316.46	1 1 1	: C : Y	TVITAJOHO EIGHT (g)	PERCENT : FIBER :S	517E	FINAL BESULT PERCERT FINE	S R	SIZE OF LARGEST PARTICLE	HINIHUH 1 +#10 PORT	ASS OF *

11	•••••	************	
*NOEKSHEET FOR HOISTORE CONTENT OF SOILS			PART D: COARSE FRACTION EDISTURE
* ASTE D-2216 **HOPESHEET FOR SIEFE AND HYDROMETER	* *TARE \$: H-2	* * * * * * * * * * * * * * * * * * *	\$:
* ASTE D-422 (MODIFIED FOR TEMPERATURE CHARGE)			! *TARE #: FOIL :: D *TARE (g): 11.53
*MORESHEET FOR DRY PREPARATION OF SOILS	*HOIST WT. {g}: 848.00	*HOIST WI. (g): 75.9	3 *HOIST WT. (g): 97.44
a ASTH D-421			\$ *OVEN DRY NT (g): 87.42
PPDATED 3/20/90 BY D. OSTER	*NX: 18.71	1*K1: 5.9	7%*W%: 13.20% :
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*PART B:SEPARATION OF FRACTIONS *	*PART E: SIEVE OF COARSE FRACTIC		: ::::::::::::::::::::::::::::::::::::
*WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 460.29		* FIRAL RESULTS	* SIZE OF MINIMUM MASS OF
*WEIGHT OF AIR DRY TARE (g): 194.89	* WEIGHT (g) FIRER		* LARGEST +#10 POETIOR
**************************************	*TARE (g) 65.50		
*WEIGHT OF -\$10 FRACTION + TARE (g): 370.03		* 3° 100.0% % 2° 100.0%	3 5000g
*WEIGHT OF +#10 FRACTOR, AIR DRY (g): 90.18	* 2° 65.50 100.0		* 2* 4000g
*OVER DRY NEIGHT OF FIRES (g): 165.31	* 1° 65.50 100.0		* 1 2000g
*OFEN DRY WEIGHT OF COARSE FRACTION (g): 79.66	* 3/4° 65.50 100.0	•	* 3/4" 1000g :
*OVER DRY NEIGHT OF TOTAL SAMPLE (g): 244.97	* 3/8" 86.53 91.4		* 3/8" 500g :
*PIDS T. BYDDAWESTD STOP AS TITL TRIGGIAS	*** ** *** ***		:
PART F: HIDROMETER TEST OF FIRE FRACTION	# #10 96.49 87.3 # PAN 113.72 80.3		*MEETS ASTH REQUIREMENT? HO :
PEYDROMETER TYPE: 1528	* PAN 113.72 80.3	\$\$ \$40 80.4% \$ \$60 72.5%	1
PETDROMETER HOMBER: 15-1515	***********************		* D10: B/A :
*BEALER HOMBER:	*PART G: SIEVE ON FIRE FRACTION		* D30: H/A
*FLASK RDMBER: 2	1	* 0.0485 18.3X	* D60: B/A
*SPTTFIC GRAVITY: 2.56	* CDEGLATIVE PERCENT		* Cu: B/A
4. 3 TESTED: -\$10	* WEIGHT FINER	* 0.0176 12.2%	* Cz: R/A
*MULDI WT. OF SOIL (g): 71.00 *CORRECTED DRY WT (g): 55.99	*TARE (g) 76.42	44144	1
*Pm: 1.00		* 0.0065 8.3% % 0.0033 7.7%	######################################
STANDARD SOLUTION	* #40 81.77 92.0		* BUIES:
*ZERO CORRECTION	* #60 87.83 83.0		1
	* \$100 110.58 49.0		::
* TEMP. READ.	2 \$200 127.57 23.6		1
2 19.60			*************************************
1 25.50	ZEBO CORR. CORR. CORR. FACTOR FACTOR	EFF. CORSTANT TIMER DEPTE (TAGE)	TIN ION PROPER
	G (CONTROL) t a	I FINER DEPTE (TAGs) L,cm I	DIAM. LOG TTOTAL : (mm) DIAM. SAMPLE :
			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
	5 4.14 0.40 1.02	20.9% 13.261 0.01332	0.0485 -1.31 18.322
8 8 19 0 ***** 3.00 22.6 15		17.13 13.671 0.01332	0.0284 -1.55 14.9%:
- B B 24 0 ***** 8.00 22.4 13		14.0% 13.999 0.01332	0.01761.75 12.22:
8 8 36 0 ***** 20.00 22.6 12	0 4.14 0.40 1.02	12.5% 14.163 0.01332	0.0112 -1.95 11.03:
8 9 16 0 ****** 60.00 22.6 10		9.5% 14.491 0.01332	0.0065 -2.16 8.3%
2 8 12 7 0 xxxxxx 231.00 22.8 9 - 8 16 58 0 xxxxxx 522.00 22.6 9		8.8% 14.573 0.01332	0.0033 -2.48 7.7%
9 B 55 0 ***** 522.00 22.6 9 9 B 55 0 ******1479.00 22.4 8		8.0% 14.655 0.01332	0.0022 -2.65 7.033
- 0 00 V *****1913.UV 11.9 0	5 4.20 0.40 1.02	7.1% 14.737 0.01332	0.0013 -2.88 6.2%
:::::::::::::::::::::::::::::::::::::::	***********************	*********************	**************************
PROJECT: EORSABTO/RI/FS/ID	#14¥ A44 5		GOLDER ASSOCIATES IRC.
PROJECT RUBBER: 913-1101 TECHNICIAN: MF	TASK: 208 DATE:	3 11/13/91	GEOTECHNICAL TESTING LABORATORY
::::::::::::::::::::::::::::::::::::::			REDBOND, WASBINGTON 2

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	TORE CORTERT OF SOILS						INE FRACTION B				
* ASTE D-2216		•	*	1014898 BATE		**************************************	THE THUSTERN P		* 1 A A I D . CO	jags tabotton	BUJULUA.
*NORISHEET FOR SIEVE			TABE 1:			FTARE ::			TARE :	8	
	(RODILIED LOS LEREZBY	TORE CHARGE)	STIDE (a)	•	158 35	*** IPE ( -1 -		วะ กว	*TARE (g):	25.02	
	PREPARATION OF SOILS	IVES VERNEE;	ENDIST ME	(0).	818 50	THATE INT	(g): WI (g):	51 RQ	*MOIST WI. (		
* ASTH D-421	TOTOTAL AL MAINA		TOTAL DRY	, (8). YP (a).	701 79	TOURN DRY	\&/· ¥7 /#\·	\$1.00 Kn 81		(g): 36.62 [(g): 34.58	
	0/90 BY D. OSTER		*KI:	H1 (R).	21.483	•UFA PEL :	H: (K)-	4.19%			
	0/30 DI D. USIBB 111111111111111111	*********		********			********			22.15	
*PART B:SEPARATION (		************		SIEVE OF COAR				} <b>***</b>	,	} <b>******</b>	*******
* FAMI D: SEFAMATION (	// factions		*FARI B: 1	THIP AT CARR			35111111111111111111111111111111111111	*******	*******	••••••	
-	E + TARE, AIR DRY (g):	£10 01	1	COROLATIVE			FINAL RESULTS		* SIZE OF		
*WEIGHT OF AIR DRY		194.81	•	WEIGHT (g)			PERCENT FINER		LARGEST		MISS OF
*HEIGHT OF -\$10 TARK		194.81								+\$10 PO	
TOTAL TO PROPERTY.	CTION + TARE (g):	194.01 Eng Ei	*TARE (g)		,	<b>:</b> 3°	100.0%	,	* PARILULA	REQUIRE	_
	CTION, AIR DRY (g):		* 3°	76.41	100.04	* 2 ⁻	100.01		: 3*		
			2·				100.04		2 2	5000g	
*WEIGHT OF +#10 FRAC		16.40		76.41	100.03		100.0%			4000g	
*OVEN DRY WEIGHT OF	IIDED (g):	295.29	* 1°	76.41	100.034	•	100.0%		1	2000g	
SOARE DRI METCHE OF	COARSE FRACTION (g):	13.43	2 3/4	76.41	100.034	•	100.0%		3/4"	1000g	
	TOTAL SAMPLE (g):		<b>3/8</b> °	76.41	199.034		100.0%		¥ 3/8°	500g	
				76.49	100.034		99.7%		1		
	TEST OF FINE FRACTION		<b>*</b> \$10	77.46	99.721		98.4%			BEQUIREMENT?	
<b>1</b>			* PAN	78.62	99.314		95.5%			**********	*******
*HYDROMETER TYPE:	152H		t		1		90.4%		1		
*BYDROMETER NUMBER:				*******			73.8%			H/A	
*BEALER HOMBER:	4		*PART G: S	SIEVE ON FIRE	FRACTION F	<b>\$200</b>	45.7%		* D30:	N/A	
RONDER:	4		<b>t</b>		1	* 0.0456	33.1%		2 D60:	N/A	
FUNDING TESTED:	2.31		1	CUMULATIVE	PERCENT :	. 0.0274	24.6%			R/A	
*runtion tested:	-\$10		t	WEIGHT		* 0.0172				R/A	
*MOIST WY. OF SOIL (	(g): 78.09		1				14.6%		1	.,, _	
*CORRECTED DRY WT (g	z): 74.95		TARE (g)	78.42	1	* 0.0065	11.1%		*********	*********	******
‡ <b>?</b> a:	1 00		1 120	79.37	98.7%		-7:-			OTES:	
*STANDARD SOLUTION	•		* \$40	81.57	95.8%	0.0023			1	••••	
*ZERO CORRECTION			* #60	79.37 81.57 85.38	90.73				1		
<b>‡</b>	•••		<b>2</b> \$100	97.84	74.134		•		1		
* TEMP. READ.			* \$200	118.97	45.9%				:		
¥ 19.60 5.00	····		-					******	**********	**********	*******
<b>25.60</b> 3.00	ELAPSED		ZERO	CORR.	CORR.			TART			
1	TIME	TEMP. HYDRO	CORR.	FACTOR	FACTOR	* FINER		åGs)	DIAH.	LOG	TTOTAL
*D BR B	S (ain.)		(COBTROL)		8	4 11144	L,ca	ľ	(BB)	DIAE.	SAMPLE
<b>‡</b>				·					\##/ 	******	OUNT DO
* 8 8 3	18 0 222222 0 .00										
	9 0 ***** 1.00		4.06	0.40	1.07	33.3%	11.703 0	.01332	0.0456	-1.34	33.1
	11 0 222222 3.00				1.07	24.73		.01332	0.0274	-1.56	24.6
• • • •	6 0 ***** 8.00				1.07	19.0%		.01332	0.0172	-1.76	18.9
•	8 0 ***** 20.00				1.07	14.74		.01332	0.0172	-1.76	14.5
	18 0 ***** 60.00				1.07	11.13		.01332	0.0111	-1.36	
	3 0 ***** 205.00					8.3%		.01332		-2.13 -2.45	11.1
	1 0 ***** 503.00				1.07				0.0036		8.3:
					1.07	7.5%		.01332	0.0023	-2.64	7.5
·	68 0 ******1460.00	22.3 8.0	4.23	0.40	1.07	5.91	14.819 0	.01332	0.0013	-2.87	5.9
•		*******									
	#ARCIDEA (NT (PC (TR	,11111111111111111	*********	**************	**********	*********	***********				*******
*PROJECT:	MORSARTO/RI/FS/ID			***					GOLDER ASSOCI		-:
*PROJECT HUMBER:	913-1101		TASE:	208	DATE	11/13/91				TESTING LABOR	RATORY
*TECHNICIAN:	EF		REVIEWED	BY:	DATE:				REDEOND, WASE		
	*****************	.111111111111111111	1111111111	**********	**********	.######################################	***********	*******	} <b>*****</b>	/ <b>*******</b>	11111111:

														********		
:11	•			1111111111		*******										: WATERTIES -
ROSK				CRIENT OF	SULLS				TINKAP MOTEI			IMP INTOILE	N ENISIAKE	*PARI D: C	COARSE TRACTION	EDISTURE *
		TH D-221		######################################	h			*			TARE 1:		21	•	19	•
	SSEET	IOR 215	AP PAD	ETDROEFTE	BENSEDIÐ K			STARE S:			TARE (g):		31	STARE S:	12	
******				FIED FOR		ARP CERM		*TAPE (g):	( <b>-</b> \ .					*TARE (g): *BOIST NI.		
				ATION OF	20172			*HOIST WT.			MOIST NT.				. (g): 00.00 WI (g): 85.76	
*		78 D-421		T D 00001	<b>.</b>			*NT:	(1 (g):	29.95%	OPEN DRY I	(I (E):		****:	3.80 tk	
1				T D. OSTE								********			J.D. ! <b>!!!!!!!!!!!!!!!!</b> !	
					• • • • • • • •	******		######################################	TERE OF COID	SE FRACTION			•••••	•••••	************	•••••••••••••••••••••••••••••••••••••••
· PARI	B:21	PARATION	U2 2 EA	CIIUND				T : DI	IBTE OF CORD				********	*******	***********	*********
*****	70 DA	941 C1WD	17 · •	DP 110 N1	DV (a).	11 011		•	COMOLATIVE			FIRAL RESU		* SIZE OF		MASS OF *
				RE, AIR DI	ri (8):	274.17			WEIGHT (g)			PERCERT FI		* LARGEST		
		AIR DRY				274.16				44841				- PARTICL		
				+ TARE (g)	١.	548.38		*TARE (g)	78.06			100.0%		1	TAIVPEA AL	1
				AIR DRY		274.22		* 3.	78.06	100.03	•	100.0%		<b>3</b> °	5000g	1
				AIR DRY (		10.17		* 2 ⁻	78.06	100.03		100.03		2.	4000g	•
		nelgar o			51-	267.12		· 1·	78.06	100.03		100.03		i i	2000g	1
				E FRACTION	(4).	9.80		· 3/4°	78.06	100.03		100.0%		± 3/4°	1000g	*
				SAMPLE (		276.92		* 3/8°	78.06	100.03		99.9%		± 3/8	500g	*
				) 441246 			*******	•	78.43	99.93		99.5%		1	and	*
				ON FIRE FI			•••••	<b>*</b> #10	79.33	99.5%		99.5%		TOL STERK	B REQUIREMENTS	' NO 2
: ANI	1 - 11	IDACULIA	4 1701	OF FIRE F	PECITOR			* PAR	80.81	99.01		96.5%			33333333333333	
ם תדום	nwitt	R TYPE:			152B			1	00.01	10.04		95.0%		1		1
		R ROEBER		,	15-1515			- *********	*********	*********		91.9%		* D10:	H/A	1
	ER NO		•	•	25					FRACTION 4	. •	85.0%		* D30:	B/A	1
	I NON				1			1 2 M 1 G . D	IPIP OD IIND		0.0395	66.3%		* D60:	N/A	1
		GRAVITY:			2.25				COMOLATIVE			63.9%		* Cu:	R/A	
-51 ·		ESTED:			-\$10				WEIGHT	FIRER		58.4%		* Cz:	N/A	
_		OF SOIL	10).		69.88							48.9%		1	M/ E	<b>—</b> — ;
		DRY NT			68.07			*TARE (g)	70.75			38.7%		1111111111		21111111111
RE:	LOILD	D01 W1	161.		1.00			¥ \$20	70.75	100.01		28.8%		1	NOTES:	1
	קסות	SOLUTION			1.00			± \$40	72.80	97.0%		26.1%		1	NO. DO.	1
		ECTION					*		73.85	95.4%		18.13		·	<del></del>	
- 45.00		 					_	* \$100	75.95	92.42		20.24				
: TEE	p p	EID						¥ \$200	80.02	86.43				1		1
: 19.		5.00										********	*******	********	**********	*********
25.		2.50		1	ELAPSED			ZERO	COPR.	CORR.			CONSTART			1
	•	•.••		•	TIME	TEBP.	EYDRO	CORR.	FACTOR	PACTOR	I FIRER	DEPTH	(TåGs)	DIAM.	LOG	TIOTAL :
D	ER	Ħ	S		(min.)	(C)	READIRG	(CORTROL)	t	à.	7	l,ca	I	(88)	DIAH.	SAMPLE *
							•••••									
	15	11	14	0 *****	0.00				•							1
	15	11	15	0 *****	1.00	21.1	46.0	4.24	0.20	1.08	66.67	8.587	0.01348	0.0395	-1.40	66.31:
	15	11	17	0 111111	3.00	21.1	44.5	4.24	0.20	1.08	64.22		0.01348	0.0231		
	15	11	22	0 222222	8.00	21.1	41.0	4.24	0.20	1.08	58.62		0.01348	0.0146		
	15	11	34	0 ::::::		21.1	35.0	4.24	0.20	1.08	49.12		0.01348	0.0097		
	15	12	14	0 121111		21.2	28.5	4.20	0.20	1.08	38.91		0.01348	0.0059		
	15	14	14	0 111111		21.8	22.0	3.98	0.20	1.08	28.93		0.01348	0.0036		
	15	17	30	0 222223		22.1	20.0	3.86	0.40	1.08	26.23		0.01332	0.0025		
	16	8	37	0 ******		20.3	16.0	4.55	0.00	1.08	18.23		0.01365	0.0014		
	-	-		•		•	3 <b>.</b>	••••	• • • •							1
****	11111	******	111111	*******		1111111		*******	********	********	*******	*********	********	********	**********	*********
PROJ	ECT:		KON	SARTO/RI/I	FS/ID									GOLDER ASS	OCIATES INC.	1
		DEBER:		-1101				TASE:	208	DATE:_ ~	11/13/91				AL TESTING LAB	ORATORY :
TECE	RICIA	R:	BA					REVIEWED I	37: _	DATE: DR		_		REDMOND, N	ASEINGTOR	1
				*******		*******							*******		**********	:::::::::::
																_

### SCHEDULE OF LABORATORY TESTS

																					DATE IN 11-19-91  DATE DUE
BORING	SAMPLE	Atterberg Limits	Moist. & Desc.	Mod. Proctor	Std. Proctor	Sieve & Hydro	Specific Grav.	Consol.	3	В	Slake Dur.	CBR	Uncorif. Com.	F.W. Perm.	R.W. Perm.	Recompact	Ŧ	Min. Hesisilivily	Vane Shear		COMMENTS
C-1.	,		M																		If material is coarse do wash sieve instead of hydro.
C-Z																					If there is not enough material, skip moisture and do S.G. on sicur/hydro
c-3,				. 7			95														sample
	·	-	4	1		· · · · · · /	No.														Engineer's Copy
Q-2.	,			X				:													
PO-1			14				TO TO														
PO-2			**			· E															
PO-ZR			Ü				A.														
PO-3						TEN.															
TD-1		4	#											,							•
	Test Starte Test Compl				l ∞ •	ngin iple:		give	∍n											_	only for CU,UU and g billed to project directly.

### SCHEDULE OF LABORATORY TESTS

PF	ROJE	C	r :	SH	10	R٦	Γ 7	TΠ	ΓL	Ε_	Ma	)/\S	an	to	<u>/_</u>	RI	1	FS	>_	_/_		1)		DATE IN 11-19-9
																								DATE DUE
BORING	SAMPLE	Atterberg Limits	Moist. & Desc.	Wash Sieve	Mod. Proctor	Std. Proctor	Sieve & Hydro	Specific Grav.	Shelby Ext.	Consol.	M	മ	Slake Dur.	CBH	Unconf. Com.	F.W. Perm.	R.W. Perm.	Recompact	Hd	Min. Resisitivity	Vane Shear			COMMENTS
TD-IR																								
NDF-1						-		100																
NDF-1A							阿		P															
																			·					
	Test Starte	đ					ngir		r g	ive	n			L	.abo	orat	ory	/ SL	ıbır	nits	dr	aftir	ng	only for CU,UU and

Billed

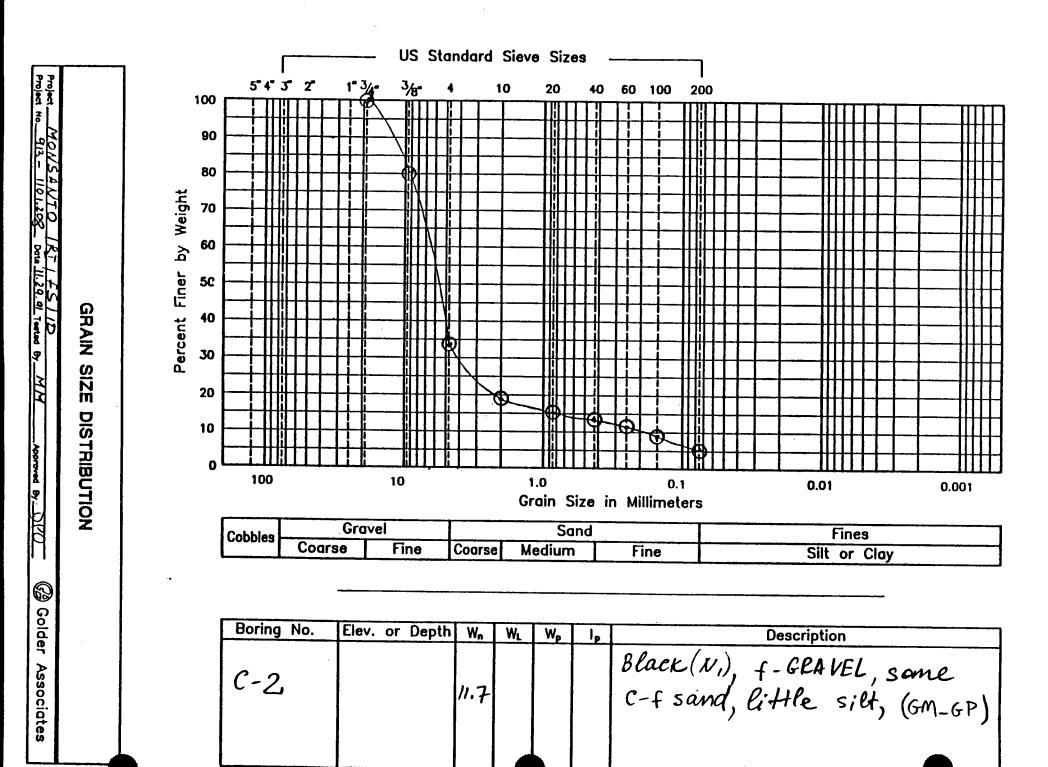
Completed

consolidation tests. Drafting billed to project directly.

US Standard Sieve Sizes 5"4" 3" 2" 60 100 200 100 90 80 by Weight 70 60 Percent Finer 50 GRAIN 40 **30** SIZE 20 DISTRIBUTION 10 100 10 1.0 Grain Size in Millimeters Gravel Sand Cobbles Coarse Fine Coarse Medium Fine Associates

0.01 0.001 Fines Silt or Clay

Boring No.	Elev. or Depth	Wn	WL	W _P	اوا	Description
C-1		3.7				Black (N1), F. GRAVEL and C-SAND, Trace sill, (GP).



US Standard Sieve Sizes 5"4" 3" 2" 3/8" 10 40 60 100 20 200 100 90 80 Weight 70 ۿ 60 Percent Finer 11.29 91 Tested By MM 50 GRAIN 40 30 SIZE 20 DISTRIBUTION 10 Approved By 1000 100 10 1.0 0.1 Grain Size in Millimeters ) Golder Associates

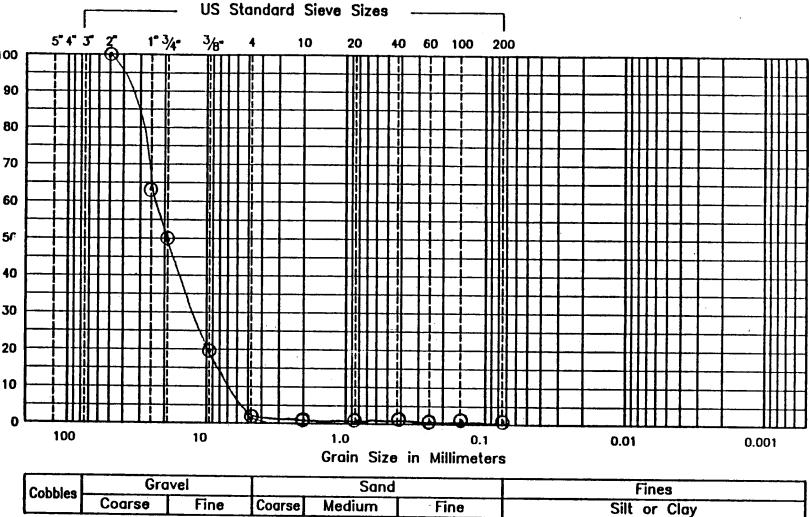
0.01 0.001

Cobbles	Gra	vel		Sand		Fines
· ·	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

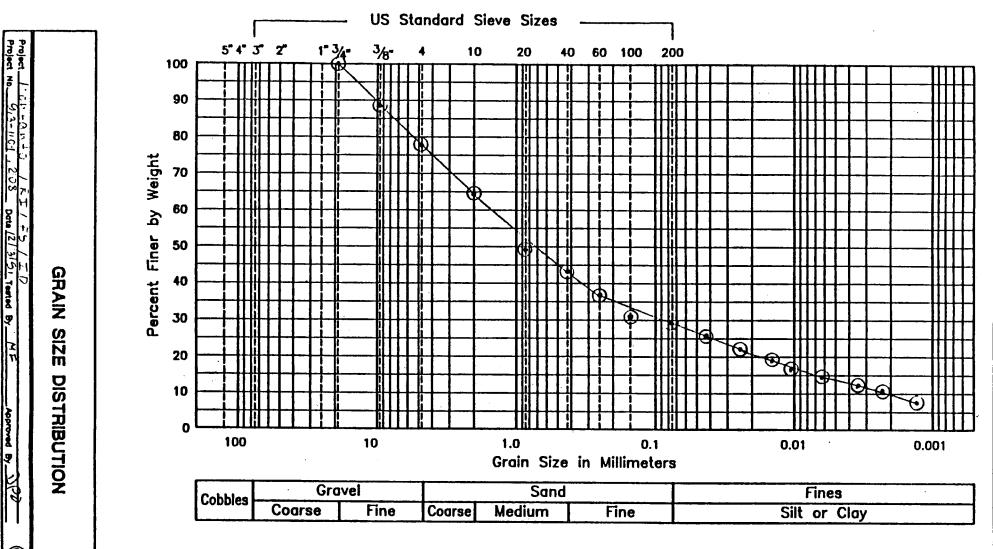
Boring No.	Elev. or Depth	Wn	WL	W _p	-lp	Description
C-3		12.9				Black (N,), f-GLAVEL, some C-f sand, trace Silt, (GW).

Golder **Associates** 

US Standard Sieve Sizes 5"4" 3" 10 60 100 200 100 90 80 Percent Finer by Weight 70 60 50 **GRAIN SIZE** 40 **30** 20 DISTRIBUTION 10 100 10 1.0 0.1 Grain Size in Millimeters Gravel Sand Cobbles Coarse Fine Coarse Medium Fine Golder Associates



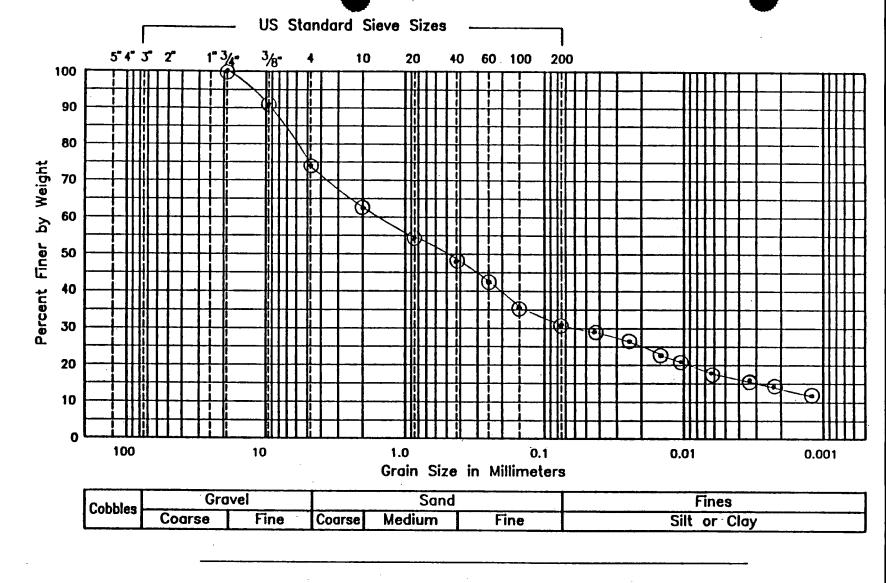
Boring No.	Elev. or Depth	Wn	W _L	W _p	l _p	Description
Q-2.		1.8				Pinkish gray (SYR 811), C-f GRAVEL, trace c-f sand, trace silt, (GP).



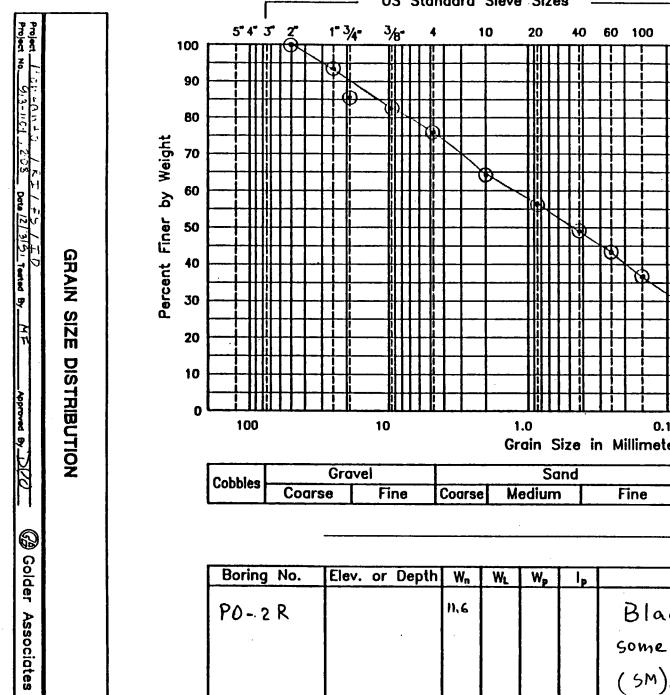
Golder

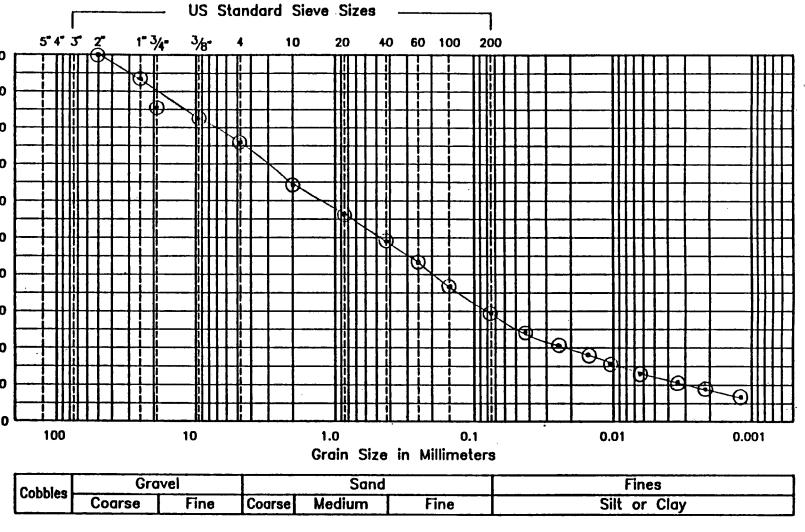
Associates

Boring No.	Elev. or Depth	Wn	WL	Wp	l _p	Description
Po-1		10.6				Black (NI); c-f SAND, some silt, some f gravel, (SM).
						(311).



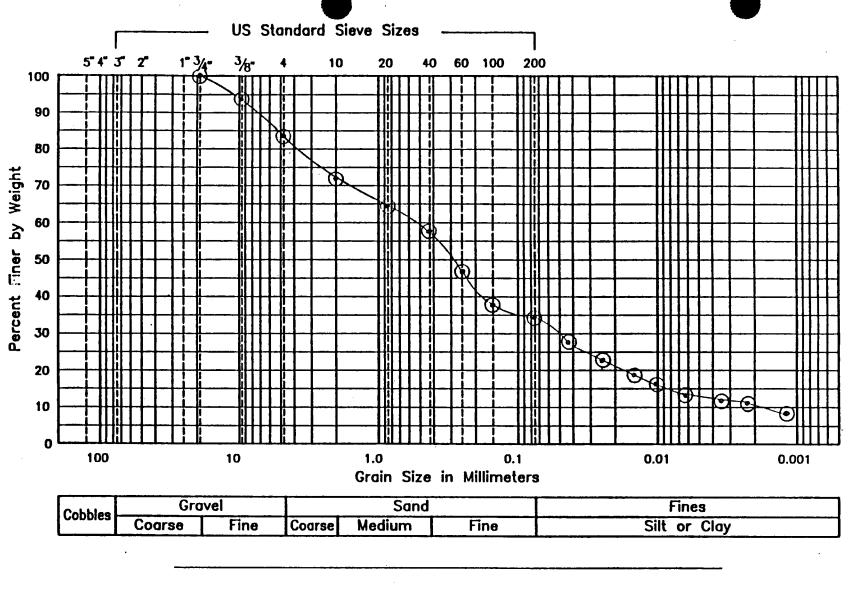
Boring No.	Elev. or Depth	Wn	WL	W _P	l _p	Description
P0-2		11.1				Black (NI), e-f SAND and SILT, some f gravel, (SM).





Cobbles	Gra	vel		Sand		Fines
Copples	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	Wn	WL	Wp	Ιp	Description
P0-2R		11.6				Black (N1) cof SAND, some sill, some cof gravel,
						(5M).

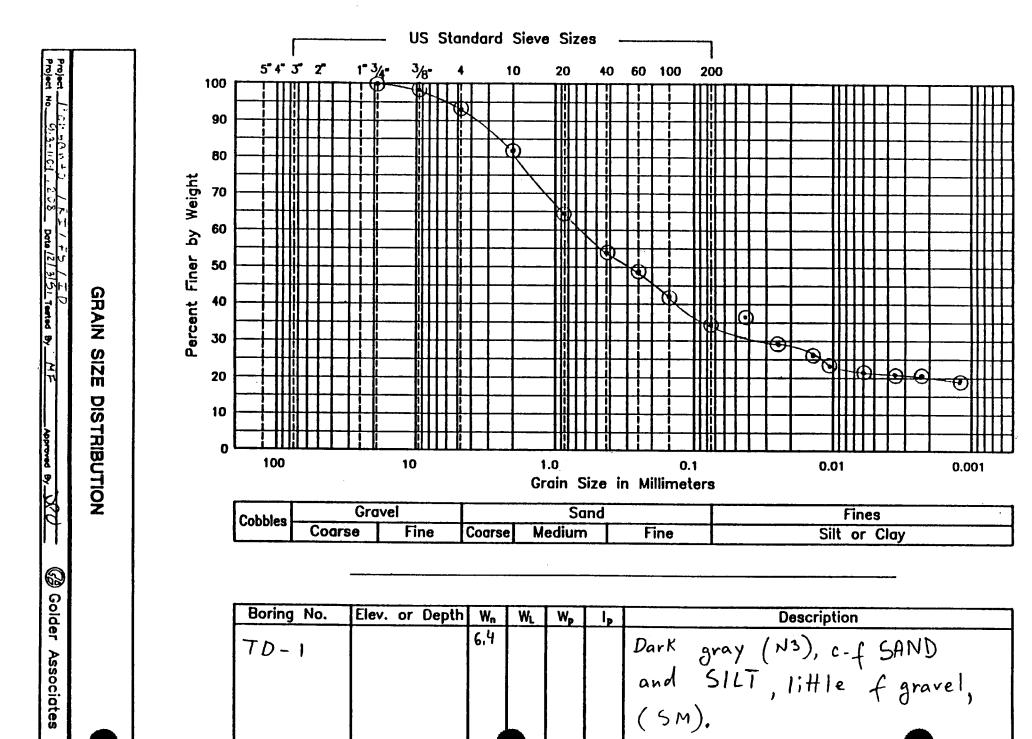


Boring No.	Elev. or Depth	Wn	WL	Wp	l _p	Description
P0-3		//,Z		•		Black (NI), c-f SAND and SILT, some f gravel, (SM).

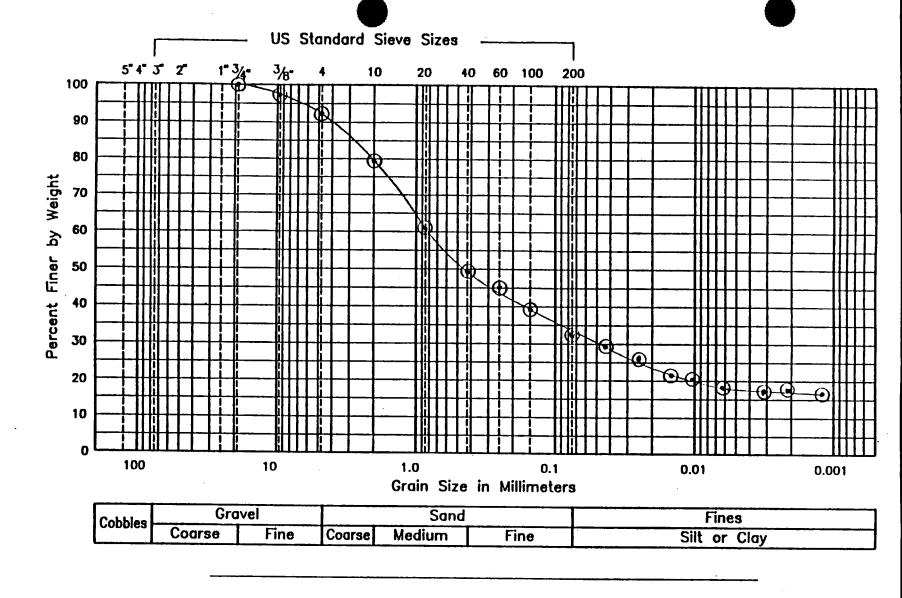
# GRAIN SIZE DISTRIBUTION

0

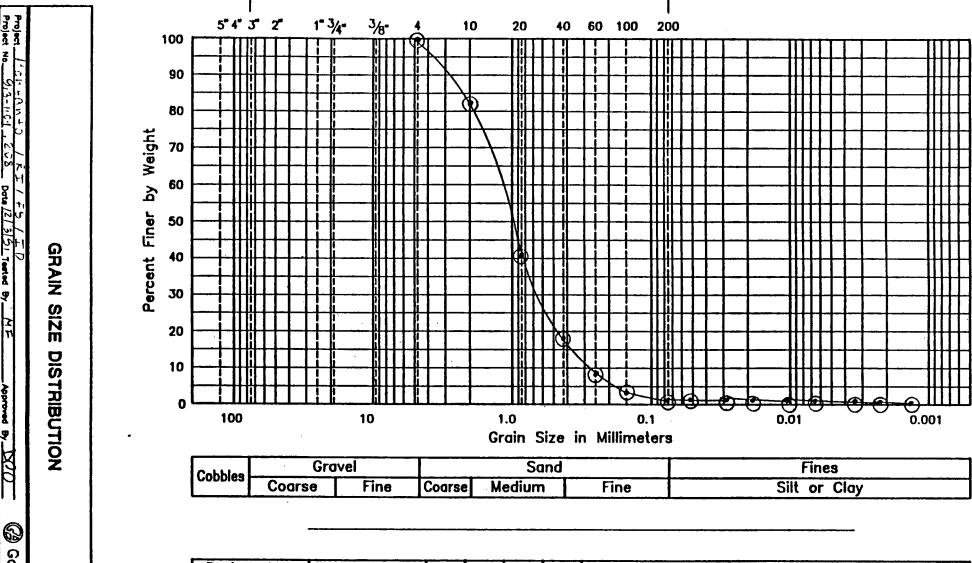
Golder **Associates** 



**GRAIN SIZE** DISTRIBUTION 0 Golder Associates



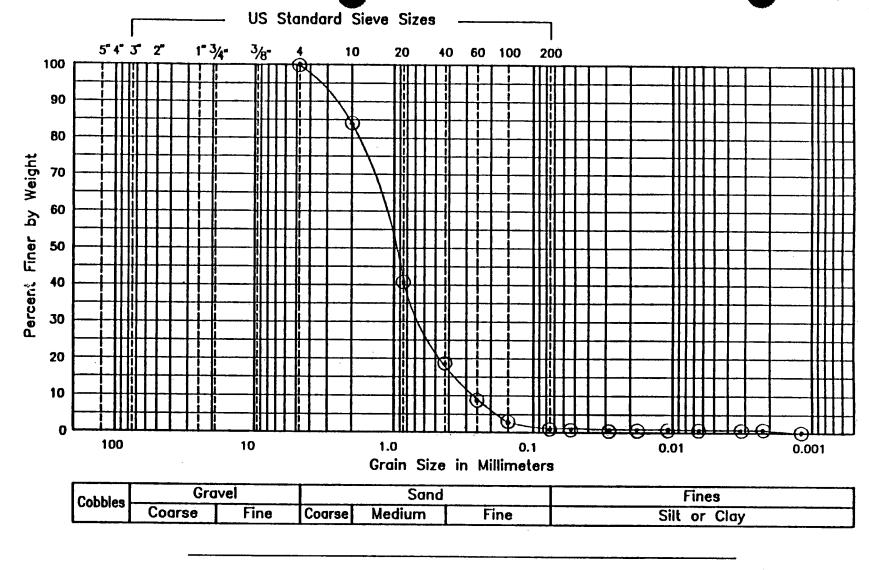
Boring No.	Elev. or Depth	Wn	WL	Wp	l _p	Description
TD-IR		14,4				grayish black (N2), c-f SAND and SILT, little f gravel, (511).



US Standard Sieve Sizes

Boring No.	Elev. or Depth	Wn	WL	W _P	l _p	Description
NDF-1		5.3				Light olive gray (5 Y 5/z), c-f SAND, trace silt, (SP).

Golder **Associates** 



Boring No.	Elev. or Depth	Wn	WL	Wp	l _p	Description
NDF-1A		5.3				Light olive gray (5 y 5/z), c-f SAND, trace silt, (SP).
	. ,					

# **GRAIN SIZE** DISTRIBUTION

Golder

Associates

GOLDER ASSOCIATES INC., REDNOND, WA STORE CONTENT CALCULATION SHEET .... D-2216

PROJECT: MONSANTO/RI/FS/ID PROJ. NO: 913-1101.208 11/21/91 DATE:

TECH: REVIEW:

MF

BORING NO	. SAMPLE NO.	WET WT. (g)	DRY WT.	TARE WI.	TARE No.	HOISTURE (X)
C	1	281.41	274.50	90.03	F	3.7
C	2	183.06	171.90	76.34	2	11.7
C	3	176.42	164.90	75.90	OB	12.9
Q	1	334.52	328.90	73.80	39	2.2
è	2	333.35	328.76	74.47	36	1.8
PO	1	109.87	101.77	25.24	16	10.6
PO	2	71.72	67.04	24.80	17	11.1
PO	2 R	93.95	86.80	25.03	33	11.6
PO	3	86.46	80.29	25.18	15	11.2
TD	1	50.67	49.13	25.14	10	6.4
TD	1R	65.77	60.66	25.08	27	14.4
HDF	1	101.90	98.02	25.08	36	5.3
AUA	11	100 32	96 55	25 01	21	5 3

CAMBLE	C-1
SAMPLE	

Pycnometer number	LO 208	
Temperature at weighings ( ^O C)	72.0 22.2	
Weight flask + soil + water (W _b )	687.05	
Weight flask + water (Wa)	658,62	
(Wa - Wb)	-28.43	
Evaporating dish number	6B	
Weight dish + dry soil	161.17	
Weight dish	96.91	· ·
Weight dry soil (Wo)	64.26	
Temperature factor (K)	2 9395	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_a - W_0)} \cdot K = \frac{1.79}{1.79}$$

Comments:

Sample passed through 3/8" sieve prior to testing

#### Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

	C-2
SAMPLE	U-Z
SAMELE	

Pycnometer number	16208	
Temperature at weighings ( ^O C)	72.0	
Weight flask + soil + water (W _b )	671.62	
Weight flask + water (Wa)	658,62	
(Wa - Wb)	-13.00	
Evaporating dish number	25	
Weight dish + dry soil	178,34	
Weight dish	105.62	
Weight dry soil (W ₀ )	72,77	
remperature factor (K)	0.9996	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} \cdot W_{b})} \cdot K = 1.22$$

Figure
SPECIFIC GRAVITY DETERMINATION, ASTM D854

SAMPLE C-3

Pycnometer number		
Pychometer humber	L0 208	
Temperature at weighings ( ^O C)	72.2	
Weight flask + soil + water (W _b )	675.56	
Weight flask + water (Wa)	658.61	
(Wa - Wb)	-16.95	
Evaporating dish number	16A	
Weight dish + dry soil	16,81	
Weight dish	('03.71)	
Weight dry soil (Wo)	58.10	
Temperature factor (K)	0,9995	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{0})} \cdot K = \frac{1.41}{1.41}$$

#### Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

SAMPLE Q-1

Pycnometer number	60208	
Temperature at weighings ( ^O C)	72 y 22,4	
Weight flask + soil + water (Wb)	697.89	
Weight flask + water (Wa)	658,60	
(Wa - Wb)	-39,29	
Evaporating dish number	A	
Weight dish + dry soil	155.40	
Weight dish	92.30	
Weight dry soil (W ₀ )	63.10	
Temperature factor (K)	0,9995	

Gg/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_a - W_0)} \cdot K = \frac{63.10}{23.81} \times 0.9995 = 2.65$$

Comments:

#### Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 413-1101. Onto 1/16/01 Tested By MF Approved By VV @ Golder Associates

SAMPLE 8-2

Pycnometer number	L0208	
Temperature at weighings ( ^O C)	71.8	
Weight flask + soil + water (W _b )	68628	
Weight flask + water (Wa)	658.64	
(Wa - Wb)	-27.64	
Evaporating dish number	1	
Weight dish + dry soll	149.09	
Weight dish ~	103.91	
Weight dry soil (Wo)	45.18	
Temperature factor (K)	0,9996	

GS/control temperature = 
$$\frac{W_0}{W_0 + (W_2 - W_0)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_0 - W_0)} \cdot K = \frac{45,18}{17.54} \times 0.9996 = 2.57$$

Comments:

Sample passed through 3/8" sieve prior to testing.

#### Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

SAMPLE PO-1

Pycnometer number	LD 208	
Temperature at weighings ( ^O C)	69.3 20.7	
Weight flask + soil + water (Wb)	673.40	
Weight flask + water (Wa)	658.79	
(Wa - Wb)	-14.61	
Evaporating dish_number	20	
Weight dish + dry soil	124,74	
Weight dish	101.66	
Weight dry soil (Wo)	23.08	
Temperature factor (K)	0.9999	

Gg/control temperature = 
$$\frac{W_0}{W_0 + (W_2 - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_0 - W_0)} \cdot K = \frac{23.08}{9.47} \times 0.9999 = \frac{2.72}{9.47}$$

Comments:

Figure
SPECIFIC GRAVITY DETERMINATION, ASTM D854

SAMPLE PO-2

Pycnometer number	L0208
Temperature at weighings ( ^O C) 69.8	21.0
Weight flask + soil + water (W _b )	668.45
Weight flask + water (Wa)	658.76
(Wa - Wb)	-9.70
Evaporating dish number	7
Weight dish + dry soil	123.45
Weight dish	108.02
Weight dry soil (Wo)	15.43
Temperature factor (K)	0.9998

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_0}{W_0 + (W_a - W_b)} \cdot K = \frac{2.69}{}$$

Comments:

## Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Proped No. 913-1101. Date 11/16/91 Tested By SA Approved By 90 @ Golder Associates

#### SAMPLE PO-2R

Pycnometer number	LO-208	
Temperature at weighings (OC)	69.8	
Weight flask + soil + water (W _b )	676.38	
Weight flask + water (Wa)	658.76	
(Wa - Wb)	-17.62	
Evaporating dish number	25	
Weight dish + dry soil	133,43	
Weight dish	105.63	
Weight dry soil (Wo)	27.80	
Temperature factor (K)	0.9998	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_a - W_0)} \cdot K = \frac{27.80}{10.18} \times 0.9998 = 2.73$$

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854



SAMPLE PO-3

Pycnometer number	L0208
Temperature at weighings (OC)	68.67 20.3
Weight flask + soil + water (Wb)	673.90
Weight flask + water (Wa)	658.83
(Wa - Wb)	-15.07
Evaporating dish number	6A
Weight dish + dry soil	126.54
Weight dish	103.72
Weight dry soil (W ₀ )	22.82
Temperature factor (K)	1.0000

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_a - W_b)} \cdot K = \frac{Z.9L}{}$$

Comments:

#### Figure . SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 913-1161. Date 11/16/01 Tested By BA Approved By DO



SAMPLE TD-1

Pycnometer number	10.208	
Temperature at weighings ( ^O C)	68.2 20.1	
Weight flask + soil + water (Wb)	670.32	
Weight flask + water (Wa)	658.85	
(Wa - Wb)	-11,47	
Evaporating dish number	4	
Weight dish + dry soil	120,14	
Weight dish	101.69	
Weight dry soil (Wo)	18.45	
Temperature factor (K)	1.0000	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_a - W_0)} \cdot K = \frac{18.45}{6.98} \times 1.0000 = 2.64$$

Comments:

#### Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project ALCHGUNTO / RI / FS / ID
Project No. 913-11 C1. Date 1/14/81 Tested By MF Approved By DVO



SAMPLE TD-IR

Pycnometer number	10208	
Temperature at weighings ( ^O C) 69	8°F 2.1	
Weight flask + soil + water (W _b )	671.16	
Weight flask + water (Wa)	658.76	
(Wa - Wb)	-12.40	
Evaporating dish number	6B	
Weight dish + dry soil	116,28	
Weight dish	96.51	·
Weight dry soil (W ₀ )	19.37	
Temperature factor (K)	0.9998	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_0}{W_0 + (W_2 - W_0)} \cdot K = \frac{2.78}{2.78}$$

Comments:

## Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project Mich Sunto /RI/FS/ID
Project No. 913-1161. Data 1/14/91 Tested By BA Approved By SO Golder Associates

SAMPLE NDF-1

Pycnometer number	Lo 208	-
Temperature at weighings ( ^O C)	19.7	
Weight flask + soil + water (W _b )	(89.70	
Weight flask + water (Wa)	658,90	
(Wa - Wb)	-30,80	
Evaporating dish number	9	<del>-</del>
Weight dish + dry soil	158,52	
Weight dish	107.39	
Weight dry soil (Wo)	51,13	
Temperature factor (K)	1.0001	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_0 - W_0)} \cdot K = \frac{51.13}{20.33} \times 1.0001 = 2.52$$

Comments:

#### Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 1915-11 CI. Date 11/16/01 Tested By NV Approved By DCC @ Golder Associates

#### SAMPLE NDF - 1A

Pycnometer number	10208	
Temperature at weighings ( $^{\circ}$ C) $\beta$	7.7% 19.8	
Weight flask + soil + water (W _b )	692	
Weight flask + water (Wa)	658.89	
(Wa - Wb)	-33.11	
Evaporating dish number	A .	
Weight dish + dry soil	159.37	
Weight dish	103,92	
Weight dry soil (Wo)	55.45	
Temperature factor (K)	1.0000	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{0})} \cdot K = 2.48$$

Comments:

## Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project ALCINGANTO / RI / FS / ID Project No. GIS-IICI. Data / Ib/GI Tested By ISA Approved By DEU



OLDER ASSOCIATES	REDNON	D, WA			!					!			
STM D-1140/C-136 IBVE ANALYSIS						SIZE OF LARG PARTICLE #10		ABPLE	MASS OF REQUIRED Og				
ROJECT ROJECT NUMBER NGINKER	HONSANTO/RI 913-1101.20				!	#4 3/4" 1"			500g 1500g 2000g				
ATE SCHNICIAN SVIEWER	11-21-91 MM/MP DVO	<u>-</u>				2- 3-		400 500	10 <b>g</b>				
ORRHOLE HUMBER AMPLE HUMBER EPTE (ft)	* C	* *	C 2		<b>::::::</b> :	C	* * *	:::::	<b>Q</b> 1	‡ ‡ ‡	:::::	Q 2	**************************************
	* F * 90.03 * 281.41				<b>:::::</b> :	OH 75.9 176.42	::::::::: <b>:</b> : :	:::::	39 73.8 334.52	* * *	:::::	36 74.47 333.35	. : : : : : : : : : : : : : : : : : : :
RY WY + TARE (g)			171.9 11.7		: : ::::::	164.9 12.9%	::::::::	:::::	328.9 2.2%	* *	:::::	328.76 1.8%	1 1
	* COMPLATIVE * WEIGHT (g)		COMOLATIVE WEIGHT (g)	PERCENT *		8 Weight (g)	PERCENT *		CONOLATIVE WEIGHT (g)			COMULATIVE WEIGHT (g)	PERCENT S
TARE (g)	* 90.0 * 90.0		76.4 3" 76.4			75.9 75.9	* 100.0X		73.9 73.9	‡ 100.0%	3-	74.5 74.5	100.0%
2" 1"	* 90.0 * 90.0	100.03*	2 76.4	100.0%	2"	75.9 75.9	100.03* 100.03*	2"	73.9 73.9	100.0%* 100.0%*	2-	74.5 167.0	100.0% 63.6%
3/4 ⁻ 3/8 ⁻	\$ 90.0 \$ 99.6	94.81	3/8" 95.2	80.4%	3/8"	75.9 103.7	100.0%* 68.8%*	3/8"	105.7 250.5	87.5%* 30.8%*	3/8"	202.2 278.7	49.8% 19.7%
\$4 \$10 \$20	* 199.1 * 270.1 * 271.9	2.43*	<b>#10</b> 153.9	18.931	#10	138.3 153.0 157.7	29.9 <b>%</b> 13.4 <b>%</b> 8.1 <b>%</b>	#10	314.0 323.3 324.0	5.9X* 2.2X* 1.9X*	#10	324.1 325.7 325.7	1.8% 1.2% 1.2%
#40 #60	* 272.3 * 272.7 * 273.1	1.2% 1.0%	#40 159.3 #60 160.9	13.3 <b>3</b> 4 11.6 <b>3</b> 4	140	159.5 160.1	6.1 <b>3</b> * 5.4 <b>3</b> *	#40 #60	324.1 324.6	1.9 <b>%</b> 1.7 <b>%</b>	#40 #60	325.7 325.9	1.2% 1.1%
#200					#100 #200		3.3%*	#100 #200		1.1% 0.8% :::::::::		326.6 327.2	0.8% 0.6%
RETS ASTM SAMPLE IZE REQUIREMENT?		*	NO	1	t t	NO	1 1	! !	NO	‡ ‡		NO	: :
D30	<b>2</b> 2.7 <b>4</b> 4.0	<b>†</b>	D10 0.2 D30 4.0	1	D10	1.2 4.8	1	D10 D30	5.3 9.0	*	D10 D30	7.0 14.0	
D60 Cu Cz	5.8 2.1 1.0	1	D60 6.2 Cu 31.0 Cz 12.9		D60 Cu Cz	8.1 6.8 2.4		D60 Cu Cz	10.2 1.9 1.5		D60 Cu Cz	24.0 3.4 1.2	
************	::::::::::	:::::::::::	· · · · · · · · · · · · · · · · · · ·	::::::::::::	· VA	<b>4.1</b>				•••••••		1.6	********

							######################################	**************************************	**************************************	.2222222222 -Didy p. T	. ************************************	######## Interppe	+DID4 D. CU	ARSE FRACTION M	MULCAULE :
WORLSEE	AT FOR BO	ISTORE C	CONTENT OF	SOILS						•		4	•	WAS AMOUND O	; and tellog
,	BAIR B. PF	PTA					TIDE :		15	**177 4.		1'0 1	1919E 4.	10	:
MORKSHKI	TOM D'1.	PAP TUD.	HYDROMETER				*TARE (g):		25.24	17ARE (g):	1	25.35	STARE (g):	70.32	;
			RATION OF S		JED VENU-		AMBTER UP	(e):	109.87	*HOIST WT.	(e):	48.81	MOIST WY.	(g): 178.27	:
	ASTE D-421		,BIIVO V. C	/0180		•	*OFEE DRY	. (g): NT (g):	101.77	*OVER DRY	WT (g):	48.28	SOVER DRY M.	T (g): 176.07	:
1	SPRIFER 3.	1/20/90 R	BY D. OSTER	.R		•	914:	"" 10,	10.587	Tall :	: . (g): HT (g):	2.31%	,# <b>#</b> %:	2.08%	,
*******	*******	******	*******	******	/#######	********	*********	**********	*********	*********	**********	.2222222	.2222222222	************	*******
	SEPARATION						*PART E: 5	SIEVE OF COAR	RSR FRACTION	N: SAMPLE:	P0-1				
•						,	<b>t</b>							**************************************	
HEIGHT '	TOTAL SAB	PLE + TA	ARE, AIR DE (g):	dī (g):	274.92	7		COMULATIVE					* SIZE OF		
MEIGHT	OL TIE DE.	Y TARE !	(g):		73.70	,	<b>t</b>		FIBLE	15111	PERCENT FIRER		* LARGEST		
ALIGHT	OF -\$10 T	ARE (E):		٠١.	13.14	•	*TARE (g)			\$ 3°	404 45				
ARTERI :	US -810 1	MACITUM MOTERAL	I + TARE (g) I, AIR DRY (	j: (#)•	97 87		: 3.	70.27		% 2 ·	100.0X 100.0X 100.0X 100.0X 88.3X 77.2X		: 3.	5000g	
-MEIGEL -	US-TELD L	ABULION, Professional	AIR DRY (g	(B) ·	108.35		2.			X 1.	100.0%		ž 2°	4000g	
*UASH DL *PTAT*	RI MEIGET (	OF FIRE	S (e):	167.	90.77		1		100.03		100.0%		<b>1</b> .	2000g	
AUAKE DE	Y WRIGHT	UL COTE,	SE FRACTION				3/4	70.27	100.0	x: 3/8°	88.3%		<b>3/4</b>	1000g	
OVER DE	RY WEIGHT	OF TOTAL	L SAMPLE (g	(g):	196.91	1	<b>3/8</b> °	93 39	88 33	X1 \$1			•	500g	
******	********	*******	*********	*******	********		14	115.10	77.27	X# #10	64.7%		*		
*PART F:	. HYDROBET	ER TEST	OR FIRE FR	RACTION			* \$10	139.69	64.73		49.0X			REQUIREMENT?	RO
1							* PAB	164.61			43.1%			*************	*********
	ETER TYPE:			152H			1			* \$60 ** ***	36.2% 30.3%		# D10:	m /1	
HYDROLL	TER HUBBE	,R:	1	15-1515			•	*************				,	* D10: * D30:	R/A R/A	
BEALL	AUBBEK:			8			*PART 6: 5	SIEVE ON FINE		* 0.0433			* D60:	n/a B/A	
	.o corald.	<b>a</b> .		8 2.72		•	•	COMBLATIVE	PERCERT				* Cu:	1/A	
*DUB41VE	# <b>4</b> 56455+			-210		-	•	WEIGHT		± 0.0161			* Cz:	H/A	
ANULTA L	.02 40 4F	11. (a):		69.34		•	1						1	-,-	
*LUSSEC.	ALD DEA M.	1 (p):		67.77			TARE (g)			<b>2</b> 0.0061	1 14.5%			**********	/1111111111
iRn:	<b>A</b> # #ms	101.		1.00			<b>\$ \$20</b>	88.15	75.77	<b>1</b> * 0.0035	5 12.5%			HOTES:	
*STANDAF	AD SOLUTIF	or		<del>.</del> .			1 140	94.36	66.62	<b>X</b> * 0.0024	4 10.2%		<u>:</u>		
*ZERO CC	JERECTION						¥ #60	101.59			4 7.4%		<u> </u>		
<b>\$</b>							<b>\$</b> \$100	107.77					<u>-</u>		
# TEEP.	READ.						<b>\$ \$200</b>	108.77	45.31	<b>48</b>		~~~~~	*	*******	********
				~* + nepn		,			44444444	**********	BFF. CON				********
25.30	5.00			ELAPSED		חממסם	ZEBO Cobr.	CORR. PACTOR	DICTOD	* FINER	DEPTH (	BDIANI (T&Gs)	DIAM.	LOG	TTOTAL
# * * * * * * * * * * * * * * * * * * *	48 ¥	S		TIME (min.)		HYDBO PRADIEC	(CONTROL)		STOIGE	4 IlDam	L.cn	[ I E O E )	(as)	DIAH.	SAMPLE
*	HR H			(818.,	(6)		(6081202)	, •	g 		#   v=		\		
<b>2 2</b> 5	10	19	0 222222	. 0.00	,										
<b>26</b>		20	0 *****			34.0	7.07		0.99			0.01332			
z 25	10	22	0 323223		22.6	31.0	7.07	7 0.40	0.99			0.01332			
<b>2</b> 26	10	27	0 111111	£ 8.00	22.5	27.0			0.99			0.01332			
<b>2 2 6</b>		39	0 *****						0.99			0.01332		-1.98	
2 26		19	0 *****						0.99			0.01332			
<b>2</b> 26		19	0 *****						0.99			0.01317 0.01317			
<b>2</b> 26		16	0 111111						0.99			0.01317			
27 2	8	39	0 *****	1340.00	21.8	15.0	1.00	1 4.24	. 7.44	44.1	14 10.Vt.	V. VIV.	V. ~ ~	<b></b>	* * • •
1111111	********	4222 <b>22</b> 7	***********	*****	41111111	***********	********	**********	**********		****	********	*********	*****	/ <b>:::::::</b> :
*PROJECT			ORSARTO/RI/		10000.	*****	••••		****		<del>-</del>		GOLDER ASSO	OCIATES INC.	
	T NUMBER:		13-1101	10/			TASE:	208	DATE:	11/21/91	1			AL TESTING LABOR	JRATORY
STYCERIO	CTAR:	1	HP				REVIEWED	BY:	700	<u>/</u>	_		REDMOND, WA		
	,122322222°	******	/#####################################	/2222227	*******	42222227	***********	*********	.111111111111	**********	/*************************************	********	**********	***********	,22222222

1 INCLUSION FOR MOISTORE CONTENT OF SOILS		*****************	*************	*****************	111
* ASTR D-2216	*PART A: BATURAL BO	ISTURE CORTERT*PART C: 1	FIRE FRACTION MOISTOR	RE PART D: COARSE FRACTIO	H HOISTURE :
	1	<b>1</b>		<b>1</b>	
*HORISHEET FOR SIEVE AND HYDROMETER  ASTM D-422 (MODIFIED FOR TEMPERATURE CHARGE)	*TARE \$:	17 *TARE #:		4 *TARE 8: 2	11 #
ALCO A CAR [MANACONN CAN THREE PARTICLES CHURCH]	*TARE (g):	24.80 *TARE (g):	25.2	15 \$7ARE (#): 95 1	1 1
*MODISEEST FOR DRY PREPARATION OF SOILS	*MOIST WI. (g):	71.72 *HOIST WT.	(g): 55.3	5 *MOIST WT. (g): 230.2	4 1
* ASTM D-421	*OVER DRY MY (g):	67.04 *OVER DRY	W7 (g): 54.6	3 #OVER DRY HT (g): 227.4	1
* UPDATED 3/20/90 BY D. OSTER	*XX:	11.08x*WX: ·	9.1	Erebr. n .	48 4 1
11111111111111111111111111111111111111	***************	***************	*************	**************	**********
PART B: SEPARATION OF PRACTIONS	*PART B: SIEVE OF C	DARSE FRACTION: SAMPLE:	P0-2		,
*	8	*******	*************	**************	********
*WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 361.01	* COMULATI	PERCERT :	FIHAL RESULTS	* SIZE OF MINIMO	H HASS OF #
*WEISHT OF AIR DRY TARE (g): 108.43	* WEIGHT (	) FIRER *SIZE	PERCENT FINER	T LIDERCY .AIA D	
*HEIGHT OF -510 TARE (g): 108.44				PARTICLE REQUIR	
*WIIGHT OF -PIO FRACTION + TARE (g): 225.25	*TABE (g) 95.1	* 3*	100. <b>0%</b>	1	
*WEIGHT OF -PID FRACTION, AIR DRY (g): 116.81	<b>3</b> 95.1		100. <b>0%</b>	* 3° 5000g	*
*WEIGHT OF +810 PRACTOR, AIR DRY (g): 135.77	<b>* 2* 95.1</b>		100.0%	* 2° 4000g	
FOVER DRY REIGHT OF PIRES (g): 114.02	* 1° 95.10		100.0%	* 1" 2000g	
FOVER DRY MEIGHT OF COARSE FRACTION (g): 132.93	* 3/4° 95.10	100.03: 3/8"	90.2%	* 3/4" 1000g	
FOTER DRY WEIGHT OF TOTAL SAMPLE (g): 246.94	* 3/8° 119.3	90.222 \$4	74.0%	1 3/8° 500g	
117111711111111111111111111111111111111	1222 \$4 159.20	74.0%* \$10	62.9%	1	
PART F: EYDPONETER TEST ON FIRE FRACTION	<b>* \$10</b> 186.76	62.9%* \$20	54.8%	*HEETS ASTE REQUIREMENT!	? #0 *
t	* PAR 207.9	54.3%* #40	47.8%	****************	
PETDROFFTER TYPE: 1528	<b>t</b>	* \$60	41.9%	1	1
EYDRORATER HUMBER: 15-1515	**************		35.4%	* D10: R/A	·
*BEALER BUMBER:	*PART G: SIEVE OF FI	HE FRACTION : \$200	30.6%	* D30: R/A	,
FLASI BUBBER: 7	1	* 0.0431	29.1%	* D60: N/A	
*FLASK BOMBER: 7 *SPECIFIC GRAVITY: 2.69 *POTTOR TESTED: -\$10	* COMULATIV	E PERCENT # 0.0256	25.8%	* Ca: N/A	
FOR TESTED: -\$10	* WEIGHT	PINER # 0.0161	22.5%	* Cz: R/A	
H 1. OF SOIL (g): 68.66	1	0.0103	20.2%	\$	
CORMECTED DRY WI (g): 67.02	*TARE (g) 75.86	*****	17.9%	**************	
En: 1.00	<b>\$ \$20</b> 84.51		15.2%	* HOTES:	***********
STARDARD SOLUTION	* \$40 91.95	76.03* 0.0022	14.2%	anira:	•
ZERO CORRECTION	<b>* \$</b> 60 98.20		11.43	·	<del></del> :
ER: 1.00 STANDARD SOLUTION ZERO CORRECTION	* \$100 105.18	56.3%	11.74	·———	
: TEMP. READ.	* \$200 110.23	48.7%		<u>`</u>	
19.10 5.00		**************************************	***************	***************	<del></del> *
25.70 2.50 ELAPSED	ZERO CORR.	CORR.	EFF. CONSTANT		************
TIME TEMP. HYDRO		PACTOR & FIRER		TILK 100	*****
D HR H S (min.) (C) READIN		\$ 4 1184A		DIAM. LOG	TOTAL :
		G	L, ca I	(mm) DIAM.	SAMPLE :
25 9 18 0 ***** 0.00				*******************	
25 9 19 0 ***** 1.00 22.6 34.	5 3.67 0.40	0.99 46.2%	10 /72 0 01990	0.0494	8
25 9 21 0 ***** 3.00 22.6 31.				0.0431 -1.37	29.1%*
25 9 26 0 ***** 8.00 22.5 27.				0.0256 -1.59	25.8%
25 9 38 0 ***** 20.00 22.5 25.		0.99 35.81	_	0.0161 -1.79	22.5%
25 10 18 0 ***** 60.00 22.6 22.		0.99 32.13		0.0103 -1.99	20.21
25 12 36 0 ****** 198.00 22.8 19.		0.99 28.5%	12.441 0.01332	0.0061 -2.22	17.9%
25 17 11 0 ****** 473.00 23.1 18.		0.99 24.1%	12.933 0.01332	0.0034 -2.47	15.21*
49		0.99 22.5%	13.179 0.01317	0.0022 -2.66	14.2%
26 B 19 0 ******1381.00 21.9 16.	3.94 0.20	0.99 18.13	13.507 0.01348	0.0013 -2.88	11.4%
:22227;}42322222222222222222222222222222222	<b>  }                                   </b>	******			*
GOJECT: MONSANTO/RI/FS/ID	••••••				********
ROJECT HUBBER: 913-1101	91C7. 000	3189		GOLDER ASSOCIATES INC.	ŧ
TOPEICIAN: MF	TASK: 208	DATE: 12/2/91	(	GEOTECHNICAL TESTING LABO	RATORY *
	REVIEWED BY:	DYU	1	REDBORD, WASHIRGTOR	<b>t</b>
	****************	**************	*************	*****************	******

										-			
WORLSHEET FOR HOIS			********	********	######################################	ARRESESSESS TO THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND THE PARTY AND T	.########## *NYTYNO ZON	.222222222 72P4DT C: F	THE PRACTIO	######################################	######################################	ABSE FRACTION	**************************************
: ASTE D-2216		/1 901D0			* LVPI P: NV	TIATED BATA.		1*F261 6: F1 *	AL IMPULSA.		* * PARI D: CUB	AVIIVANT SEAL	* 4401210H 3
-WOBESBEET FOR SIEV	FE AND HYDROBET				*TARE #:			STARE S:			*TARE #:	33	
	(MODIFIED FOR		URE CHAR		*TARE (g):			*TARE (g):			TARE (g):	78.43	
*WORLSHEET FOR DRY :	PREPARATION OF	/ SOILS			*BOIST WI.			*BOIST WT.				(g): 191.86 T (g): 189.27	
2 ASTH D-421 3 BPDATED 3/2	20/90 BY D. OST	7TP			*OVER DRY W	AT (E):	86.80 11.58%	*OYER DRY W X*WX:	(1 (g).		I ¥UYER UKI HI   <b>X*KX</b> :	11 (g): 189.21 2.341	
- UIDATED 5/2			/ <b>******</b>	*******	*********		********	**********	42222222			****	
PART BESEPARATION	OF FRACTIONS					IEAE OL COTE			P0-2R	^^^			1
: :WEIGHT TOTAL SAMPLE	R + TARE. AIR	DRY (g):	319.74		<b>1</b>	COMPLATIVE			PIHAL RESUL		* SIZE OF	**************************************	MASS OF #
-WEIGHT OF AIR DRY	TARE (g):		78.46						PERCERT FIR		* LABGEST	+\$10 POR	
WEIGHT OF - DID TAR	RE (g):		78.43		1			-‡			PARTICLE	REQUIRE	<b>ID</b> *
WEIGHT OF -#10 FRA			205.35		*TARE (g)	78.45		* 3.	100.0%		1		•
REIGHT OF -\$10 FRA			126.92 114.36		1 3°	78.45 78.45	100.0% 100.0%		100.0% 93.7%		* 3°	5000g 4000g	1
OVER DRY WEIGHT OF		(E).	123.95		1	93.38	93.7%		85.7%		* 1·	2000g	1
OVER DRY WEIGHT OF		10R (g):			3/4"	112.13	85.7%	•	82.64		3/4"	1000g	1
OVER DRY WEIGHT OF	TOTAL SAMPLE	(g):	235.70		<b>3/8</b> *	119.58	82.6%	32 #4	75.3%		¥ 3/8°	500g	1
.11111111111111111111111111111111111111	***********	*******	*******		21 \$4	136.62	75.3%		64.2%		1	_	
PART F: HYDROMETER	TEST OR FIRE	FRACTION			\$ \$10 • DIR	162.88	64.23		56.4%			REQUIREMENT?	
HYDRONETER TYPE:		1691			* PAB	180.47	56.7%	%: \$40 : 860	49.0X 43.2X		111111111111111111111111111111111111111	***********	######################################
HIDHOMETER HUMBER:	,	152H 15-1515							43.2% 36.3%		•	H/A	*
BEAKER HUMBER:		145				IEVE OR FIRE			29.7%			R/A	:
FLASI NUMBER:		4			1	INTE SE SULL		<b>2</b> 0.0434				R/A	1
SP GRAVITY:		2.73					PERCENT	* 0.0259	20.7%		* Cu:	N/A	
P. TESTED:		-\$10				MEIGET		* 0.0162			t Cz:	R/A	1
HOIST MT. OF SOIL		69.87			•	10 25		* ******			*		
CORRECTED DRY HT (	g):	68.24 1.00			*7ARE (g) * \$20	76.94 85.24	87.8%	* 0.0061 * 0.0034				######################################	*************
STANDARD SOLUTION		1.00			• \$40	93.09	76.3%				·	.0159.	
ZERO CORRECTION					* 160	99.21	67.43	11 0.0013			:		
;	•••				<b>\$ \$100</b>	106.53	56.63	ţ:			1		1
TREP. READ.					* #200	113.56	46.32				1		*
19.00 8.50		ELAPSED		:	ZERO			<b>********</b>		********* Corstart	\ <b>\$\$\$\$\$\$\$</b>	**********	***********
25.30 6.00			TEMP.	HYDRO	CORR.	CORR. FACTOR	CORR. FACTOR	* FIRER	EFF. C	CURSTANT (T&Gs)	DIAM.	LOG	TTOTAL :
D BR H	\$	(min.)			(CONTROL)		9 STOINE	4 11000	L,ca	I	(22)	DIAN.	SAMPLE *
			, ,	•••••	*******		-		,	-	1		
25 9 25 9	7 0 22222		22.6	33.5	7.07	0.40	0.98	38.7%	10.637	0.01332	0.0434	-1.36	24.8 <b>%</b> :
	10 0 *****		22.6 22.6	33.5 29.0	7.07		0.98			0.01332		-1.50 -1.59	
	15 0 *****		22.5	26.0	7.11		0.98	27.8%		0.01332		-1.79	
25 9	27 0 *****	<b>** 20.00</b>	22.5	23.0	7.11	0.40	0.98	23.5%	12.359	0.01332	0.0105	-1.98	15.13
25 10	7 0 22222		22.5	21.0	7.11	0.40	0.98	20.6%	12.587	0.01332	0.0061	-2.21	13.2%
		** 208.00	22.9	18.0	6.95		0.98			0.01332		-2.47	
		** 483.00 **1391.00	23.1	16.0	6.87 7.35		0.98 0.98			0.01317		-2.66 -2.87	
40 v .	10 9	*1351.0v	21.9	15.0	1.00	0.20	0.98	11.3%	13.671	0.01348	0.0013	-2.87	7.3\$\$
1221222222222222	.222222222222	********	. <b>11111111</b>		# <b>#######</b> ############################	******	/ <b>******</b>	/ <b>****</b>		/ <b>******</b>	*******	<b>4888888888</b> 7	•
PROJECT:	EORSARTO/EI										GOLDER ASSOC	CLATES IRC.	1
PROJECT ROMBER:	913-1101				TASI:	208	DATE:	12/2/91				L TESTING LABO	
TECENICIAN:	Ni.				REVIEWED B		DRU				REDBOND, WAS		<b></b>
	/XXXXXXXX	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	********	1222222	**********	/222222222	***********	**********	.21211111111	**********	,222222222	***********	*********

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OPISHET FOR HOISTORE CONTEST OF SOILS	*PART A: MATURAL HOIS	TURE CORTERT*PART C: FI	RE FRACTION HOISTURE	*PART D: COARSE FRACTION MOISTURE *
ASTH D-2216 FORISHEET FOR SIEVE AND HYDROHETER	TARE 1:	15 *TARE #:	11	*TARE \$: 37 *
ASTE D-422 (HODIFIED FOR TEMPERATURE CHANGE)	*TARE (g):	25.18 *TARE (g):		*TARE (g): 74.45 *
	*BOIST NT. (g): *OVER DRY NT (g):	86.46 *BUIST NT. 80.29 *OVER DRY N		*MOIST NT. (g): 170.64
ASTH D-421 DPDATED 3/20/90 BY D. OSTER	###:	11.201*W1:		1.961 4
**************************************	********	*************		*******************************
PART BESEPARATION OF FRACTIONS	*PART E: SIEVE OF COA		P0-3	* 
(EIGHT TOTAL SAMPLE + TARE, AIR DRT (g): 347.66			FIRAL RESULTS	* SIZE OF BIRINGH HASS OF *
FIGET OF AIR DRY TARE (g): 108.48   EIGET OF -\$10 TARE (g): 108.47	* WEIGHT (g)	FIRER *SIZE	PERCERT FIRER	* LARGEST +\$10 PORTION * -* PARTICLE REQUIRED *
	*TARE (g) 74.40	\$ 3°	100.0%	* LUBITOUS BEQUIDED *
FIGHT OF -\$10 FRACTION, AIR DRY (g): 142.15	± 3° 74.40	100.03: 2"	100.0%	1 3 5000g 1
EIGHT OF +\$10 FRACTON, AIR DRY (g): 97.03	<b>2</b> 74.40	100.0% 1°	100.0%	* 2" 4000g *
VEH DRY WEIGHT OF PINES (g): 138.78	* 1" 74.40	100.0% 3/4	100.0%	1 1 2000g 1
FINE DRY WEIGHT OF COARSE FRACTION (g): 95.16 FINE DRY WEIGHT OF TOTAL SAMPLE (g): 233.95	* 3/4" 74.40 * 3/8" 89.82	100.0x* 3/8° 93.4x* #4	93.4% 83.4%	* 3/4" 1000g * 3/8" 500g *
: : : : : : : : : : : : : : : : : : :		83.42* \$10	71.8%	1 3008
ART F: HYDROMITER TEST OF FIRE FRACTION	<b>*</b> \$10 140.34	71.83: \$20	64.3%	*MEETS ASTH REQUIREMENT? NO *
	* PAN 160.31	63.37: \$40	57.4%	***************************************
EYDROMETER TYPE: 152B	1	<b>* \$60</b>	51.2%	1 1
EYDROMETER BUMBER: 15-1515 EEAKER RUMBER: 22	*PART G: SIEVE OF FIR		42.6X 34.6X	* D10: H/A
FLASA HORBER: 8	1 TENE O. SIBIR OF FIR.	* 0.0436	27.3%	* D60: R/A *
SPF TO GRAVITY: 2.94	* COMPLATIVE	PERCERT # 0.0260	22.6%	* Cu: N/A
-6. TESTED: -#10	* WEIGHT	PINER + 0.0163	19.0%	* Cz: N/A
101ST WY. OF SOIL (g): 66.78		******	15.9%	•
	*TARE (g) 90.05 * \$20 96.84	* 0.0062 89.6%* 0.0035	13.8% 11.9%	* NOTES: *
ER: 1.00 TANDARD SOLUTION	<b>\$40</b> 103.12	80.03# 0.0022	10.7%	t t
IERO CORRECTION	<b>\$ \$60</b> 108.81	71.23* 0.0013	8.4%	1
	<b># #</b> 100 116.58	59.3%		11
TEMP. READ.	<b># #200</b> 123.83	48.23*		·
19.00 8.50 25.30 6.00 ELAPSED	ZERO CORR.	CORR.	BFF. CONSTANT	***************************************
TIME TEMP. BYDRO	COBR. FACTOR	FACTOR & FIBER	DEPIB (TåGs)	DIAM. LOG TTOTAL *
HE M S (min.) (C) READING	(CONTROL) t	8	L,cs I	(RE) DIAM. SAMPLE *
25 9 29 0 ***** 0.00			40.840	*
25 9 30 0 ***** 1.00 22.6 33.0 25 9 32 0 **** 3.00 22.6 28.5	7.07 0.40	0.94 38.03 0.94 31.53		
25 9 32 0 ***** 3.00 22.6 28.5 25 9 37 0 **** 8.00 22.5 25.0	7.07 0.40 7.11 0.40	0.94 31.53 0.94 26.43		
25 9 49 0 ****** 20.00 22.6 22.0	7.07 0.40	0.94 22.11		0.0105 -1.98 15.93*
25 10 29 0 ***** 60.00 22.6 20.0	7.07 0.40	0.94 19.31	12.851 0.01332	0.0062 -2.21 13.84*
25 12 37 0 ****** 188.00 22.9 18.0	6.95 0.40	0.94 16.53		0.0035 -2.45 11.93*
25 17 12 0 ****** 463.00 23.1 16.5	6.87 0.70	0.94 14.91		0.0022 -2.65 10.73*
25 8 20 0 ******1371.00 22.0 15:0	7.31 0.40	0.94 11.72	13.671 0.01332	0.0013 -2.88 8.43
:::::::::::::::::::::::::::::::::::::::			**********	
ROJECT: MORSANTO/RI/FS/ID				GOLDER ASSOCIATES IRC. :
ROJECT NUMBER: 913-1101	TASI: 208	DATE: 12/2/91		GEOTECHNICAL TESTING LABORATORY *
TCHNICIAB: MF	REVIEWED BY:	200	************	REDMORD, WASBIRGTOR #

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*WORKSHEET FOR MOISTURE CONTENT OF SOILS *PART A: MATURAL MOISTURE CONTENT*PART C: FINE FRACTION MOISTURE  * ASTM D-2216	
	* TARE 5: 40
* ASTH D-422 (HODIFIED FOR TEMPERATURE CHANGE) *TARE (g): 25.14 *TARE (g): 24.59	*TARE (g): 73.28
*HORISHRET FOR DRY PREPARATION OF SOILS *BOIST WT. (g): 50.67 *MOIST WT. (g): 60.27	*HOIST NT. (g): 117.62
* ASTE D-421 **OVER DRY WY (g): 49.13 **OVER DRY WY (g): 59.41	*OVEN DRY NT (g): 116.53
* DPD1TED 3/20/90 BT D. OSTEB *WX: 6.42X*WX: 2.47	X*HX: 2.52%
*PART B:SEPARATION OF FRACTIONS *PART E: SIEVE OF COARSE FRACTION* SAMPLE: TD-1	*****************************
	************************
*WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 255.06	* SIZE OF MINIMUM MASS OF
	* LARGEST +\$10 PORTION
*HEIGHT OF -\$10 TARE (g): 108.50	
	* 3° 5000g
	* 3° 5000g * 2° 4000g
*OTER DRY WEIGHT OF FINES (g): 99.38 * 1° 73.51 100.0x* 3/4° 100.0x	* 1° 2000g
	* 3/4° 1000g
*OTER DRY WEIGHT OF TOTAL SAMPLE (g): 143.06	* 3/8" 500g
	<b>t</b>
	*HEETS ASTH REQUIREMENT? NO
- IBH 191.VI 10.14- FEW 50,34	1
APREAUCED APPEND	* D10: N/A
ARRIES HOUSES	* D30: H/A
TLASK RUMBER: 9 * 0.0429 36.2%	* D60: R/A
SPRCIFIC GRAVITY: 2.64 * COMPLATIVE PERCENT * 0.0257 29.9%	* Cu: R/A
***************************************	# Cz: H/A
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	*
	**************************************
*HB: 1.00	NOTES:
*IERO CORRECTION	ŧ
<b>*</b> \$100 105.32 51.2%	*
* TEMP. READ.	1
* 19.10 8.00 *********************************	******************************
* 25.70 5.50 ELAPSED ZERO CORR. CORR. BFF. CORSTANT  TIME TEMP. HYDRO CORR. FACTOR FACTOR X FIHER DEPTE (TAGE)	DIAM IOG CROP.
TIME TEMP. HYDRO CORR. FACTOR FACTOR X FIRER DEPTE (TAGS)  BD HR H S (min.) (C) READING (CONTROL) t a L.cm K	DIAM. LOG MICTAL (mm) DIAM. SAMPLE
\$	(WB) PIDD. SADIUL
* 25 9 40 0 ****** 0.00	
25     9     41     0 ******* 1.00     22.5     35.0     6.71     0.40     1.00     44.4%     10.391     0.01332	
* 25 9 43 0 ****** 3.00 22.5 30.0 5.71 0.40 1.00 36.6% 11.211 0.01332 25 9 48 0 ***** 8.00 22.5 27.0 5.71 0.40 1.00 32.0% 11.703 0.01332	0.0257 -1.59 29.9:
* 25 9 48 0 ***** 8.00 22.5 27.0 5.71 0.40 1.00 32.0% 11.703 0.01332 25 10 0 0 **** 20.00 22.5 25.0 6.71 0.40 1.00 28.9% 12.031 0.01332	0.0161 -1.79 26.1: 0.0103 -1.99 23.6:
* 25 10 40 0 ****** 60.00 22.5 23.5 6.71 0.40 1.00 26.6% 12.277 0.01332	0.0103 -1.99 23.63 0.0060 -2.22 21.72
* 25 12 38 0 ****** 178.00 22.8 23.0 6.60 0.40 1.00 26.0% 12.359 0.01332	0.0035 -2.45 21.22
* 25 17 13 0 ****** 453.00 23.1 22.0 6.48 0.70 1.00 25.1% 12.523 0.01317	0.0022 -2.66 20.51
* 26 8 21 0 ******1361.00 21.9 22.0 6.94 0.20 1.00 23.6% 12.523 0.01348	0.0013 -2.89 19.31
<b>*</b>	
*PROJECT: MORSARTO/EI/FS/ID	GOLDER ASSOCIATES INC.
- · · · · · · · · · · · · · · · · · · ·	GEOTECHNICAL TESTING LABORATORY
*TECHBICIAN: BY RETIEMED BY:	REDHOND, WASHINGTON
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				******	******								*********	
ORISBET FOR BO ASTN D-22		CORITHI OF	20172			*PARIA: B.	PINKET BOTE			INP LEBELL	ON MOTSION		ARSE FRACTION	HOISTU
		TERDOMPER	78			-			\$ ************************************			\$ 1 ABIND A		
IOBISHEET FOR SI ASTH D-42				*****	2771	STARE S:			TARE S:			3 *TARE 1:	40	
		IFIED FOR		IURE CES	MUL)	*TARE (g):		25.08	*TABE (g):			5 *TARE (g):	70.76	
DEISEILT FOR DR		RELIAB OF	20172			*BOIST WT.			*HOIST WY.		51.4	4 PHOIST NI.	(g): 109.41	
ASTH D-42	-					*OPER DRY	KT (g):		*OVER DRY I	(T (g):			7 (g): 108.61	
		BY D. OSTE				8HZ:		14.363				63*¥3:	2.11	
RT B:SEPARATIO			******	*******				RSE FRACTION			********	*********	**********	*******
						*raki b; 5.	IBTE UP CUBI			TD-1B	********		********	******
IGHT TOTAL SAN	PLE + T	ARE, AIR D	RY (g):	219.00		1	COMOLATIVE			FIRAL BES		* SIZE OF	MIRIMOM	HASS O
IGET OF AIR DR				78.46			WEIGHT (g)	PIEER	*SIIE	PERCERT F	INER	* LARGEST	+\$10 PO	RTION
iget of -\$10 T				78.47		1						* PARTICLE	REQUIRE	D
iget of -\$10 Pi	PACTION	+ TARE (g	<b>)</b> :	179.84		*TARE (g)	71.31		<b>3</b> .	100.0	X .	<b>t</b>	******	
iget of -fid fi	BACTION	AIR DRY	(g):	101.37		<b>2</b> .	71.31	100.01	<b>2</b> *	100.0	1	1 3.	5000g	
IGBT OF +810 F	RACTOR,	AIR DRY (	g):	39.17		\$ 2°	71.31	100.0%	: 1.	100.0	1	<b>2</b>	4000g	
EN DRY NEIGHT (	of fire	5 (g):		99.33		<b>1</b> 1"	71.31	100.0%	1 3/4"	100.0	X .	* 1°	2000g	
R DRY WEIGHT	OF COAR	SE FRACTIO	R (g):	38.36		a 3/4°	71.31	100.01	1 3/8"	97.5	ľ	* 3/4"	1000g	
ER DRY WEIGHT	OF TOTAL	SAMPLE (	g):	137.69		¥ 3/8°	74.79	97.5%	1 14	92.4		¥ 3/8°	500g	
***********					*******	11 14	81.74	92.43		79.9				
RT F: EYDROMET!	ER TEST	OR FIRE F	RACTION			* #10	99.00	79.92	<b>\$ \$20</b>	60.2		*HERTS ASTN	REQUIREMENT?	NO
						* PAR	104.53	75.9%		49.7			**********	-
POBETER TYPE:			152E			1			* 160	45.0		1		
BONETER HUMBE			15-1515			********	*********	*********		39.1		•	R/A	
ARE BUMBER:		· ·	L					FRACTION		32.6			B/A	
SI HOMBER:			3			1	D. D V 1100		0.0443	29.2			B/A	
CIFIC GRAVITY:	•		2.78			-	CHRILLTINE	PERCENT		25.6			E/A	•
RTION TESTED:	•		-810				MEIGHI		2 0.0163			•		
ST WT. OF SOII	1 101.		65.93			_		11191		21.91		t Cz:	R/A	1
										20.71		*		
RECTED DRY WT	18):		64.60			*TARE (g)	76.55		0.0061	18.43			*******	******
	<b>.</b>		1.00			<b>\$ \$20</b>	92.46	75.4%		17.47			HOTES:	
INDARD SOLUTION	,					* \$40	100.97	62.2%		17.91		·		
O COBRECTION						* \$60	104.73		0.0013	16.63	\$	*		
						<b>* \$100</b>	109.56	48.9%				*	<del></del> ,	
HP. READ.						<b>\$200</b>	114.75	40.9%				<u> </u>		
.00 8.50									********		-	*********	*********	*******
6.30 6.00		ı	ELAPSED			ZERO	CORB.	CORR.			CORSTART			
** *	_		TIME	TREP.	HYDRO	CORR.	PACTOR	PACTOR	I FIRER	DEPTH	(7 <b>8</b> 6s)	DIAH.	LOG	TTOTAL
er e	\$		(min.)	(C)	READING	(CONTROL)	t	2		L,cm	I	(ea)	DIAM.	SAMPLI
25 8	56	0 *****	0.00		********			**********					**********	
25 8	57	0 *****		22.4	31.0	7.15	0.40	0.97	36 61	11.047	0.01332	0.0443	-1.35	29.
25 8	59	0 222221	3.00	22.4	28.0	7.15	0.40	0.97	32.01		0.01332		-1.58	25.
25 9	4	0 *****	8.00	22.3	25.0	7.19	0.40	0.97	27.5%		0.01332		-1.79	21.
25 9	16	0 *****		22.3	24.0	7.19	0.40	0.97	25.9%		0.01332		-1.73	20.
25 9	56	0 *****		22.5	22.8	7.11	0.40	0.97	23.1%		0.01332			
	34	0 221211		22.8	21.0	6.99							-2.22	18.
74 77	9	0 222223		23.1			0.40	0.97	21.73		0.01332		-2.49	17.
25 12	17				21.0	6.87	0.70	0.97	22.43		0.01317		-2.68	17.
25 17	17	0 *******	1401.00	21.7	21.0	7.43	0.20	0.97	20.8%	12.687	0.01348	0.0013	-2.89	16.
	••			******	********	*********	********	*********	*******	<b>:::::</b> ::::::	******	<b>::::::</b> ::::::	**********	******
25 17 26 8		*******	*******											
25 17 26 8	******											GOLDER ASSOC	TATES THE	
25 17 26 8 ************************************	MOR	SARTO/RI/I				TASI:	208	DATR:	11/21/91			GOLDER ASSOC		RATORY
25 17 26 8	####### Mor 913					TASE: REVIEWED B	208 Y:	DATE:	.11/21/91				TESTING LABO	RATORY

*HORISHERT FOR DRY PREPARATION OF SOILS	1 *TABE 8: 5 0 *TABE (g): 69.01 1 *HOIST WT. (g): 93.30 4 *OFEH DRY WT (g): 93.24 7%*WX: 0.25%
**WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 206.04	<b>†</b>
**************************************	######################################
##UDROMETER TYPE: 152E	# D10: 0.28 # D30: 0.68 # D60: 1.20 # Cu: 4.29 # Cz: 1.35
*HOIST NT. OF SOIL (g): 60.75	* HOTES:
### ### ### ### ### ### ### ##########	DIAM. LOG XTOTAL (BB) DIAM. SAMPLE
25       8       45       0 ******** 0.00         25       8       46       0 ******* 1.00       22.3       6.5       6.19       0.40       1.03       1.2x       15.065       9.0133         25       8       48       0 ******** 3.00       22.3       6.0       6.19       0.40       1.03       0.4x       15.147       0.0133         25       8       53       0 ******** 8.00       22.3       6.0       6.19       0.40       1.03       0.4x       15.147       0.0133         25       9       5       0 ******** 20.00       22.2       6.0       6.23       0.40       1.03       0.3x       15.147       0.0133         25       9       45       0 ********* 60.00       22.3       6.0       6.19       0.40       1.03       0.4x       15.147       0.0133         25       9       45       0 ************************************	2 0.0299 -1.52 0.31 2 0.0183 -1.74 0.32 2 0.0116 -1.94 0.22 2 0.0067 -2.17 0.33
# 25 17 8 0 ****** 503.00 22.8 6.0 5.99 0.40 1.03 0.7% 15.147 0.0133 # 26 8 16 0 ******1411.00 21.7 6.0 6.43 0.20 1.03 -0.4% 15.147 0.0134 # ### PROJECT: MORSANTO/RI/FS/ID # PROJECT HUMBER: 913-1101 TASE: 208 DATE: 11/13/91 # TECHNICIAN: MF - REVIEWED BT: 700	2 0.0023 -2.64 0.62 3 0.0014 -2.85 -0.32

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ACT 0-2216   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1.00   1					CORTENT O		*******	*******								ARSE FRACTION		
A STATE D- C22		8 ASTH D-2216							t	· · · · · · · · · · · · · · · · · · ·								
### ### ### #### #####################	1																	
STATE   ACT   AC		* ASTE D-422 (MODIFIED FOR TEMPERATURE CHANGE)							TARE (g):	:	25.01	*TARE (g):		24.86				
PRANTS 3/2019 BT 3.05TES									*HOIST NT.	(g):	100.32	*HOIST NT.	(g):	64.43				
PART																		
#FART   SINFAMILION OF TRACTIONS   PART   SINT OF COARSE FACTIONS SAFELE   TOP-IN #WIGHT OF OIR DET TARE (2): 215.47		UPDATED 3/20/90 BY D. OSTER														0.40	X	
STEPONTER TOTAL SAMPLE 7 TARE, ALB DRT (g): 215.47   COMPLETY FREENT   FIRE	*PART B:SEPARATION OF FRACTIONS							*******	*PART E: SIEVE OF COARSE FRACTION* SAMPLE: MDF-1A									
**************************************		•							-							*********	******	
##INCHEF OF -110 FABET (g): 114 15	31	MEISHY	TOTAL SAM	PLE + 1	LYRE' VIR .	DKI (g):	215.47			COMULATIVE	PERCENT							
##INIGHT OF -100 FRACTION, #128 PC   114.15   2															# LARGEST	+#10 PO		
**************************************	#1	RBICES PPINEI	OR -818 2	DICTIN	). B i tide (	<b>a</b> 1.	10.40		+TID7 (a)			. 1"					D	
##IGHT OF ***10 FRACTOR**, \$110 DPT (g): \$2.93	11	METCHE	OF -810 E	BTGALUI	110 964 1 444 611 1	6).  a\.	114 16								-			
### 100 CALEST FRACTION (g): 22.14													100.04		_	•		
### 100 CALEST FRACTION (g): 22.14						16/	113 61						100.04 100.04			•		
NOTE   DET MILICAT OF TOTAL SAMPLE (g):   136.35   1 / 16.35   1 / 16.34   100.0x   14   100.0x   10   84.0x   20   40.6x																_		
FABRY F: BIDNOUSTER TISTO ON FIRE FERCIONS												- •						
PART F: HIDRORITER TIST ON FIRE FRACTION   F. FIRE   F. PART   F. FIRE   F. PART   F. FIRE   F. PART   F. FIRE   F. PART   F										76.34	100.02	1 110				Sank		
### FARS 98.74 83.612 140 18.61										98 12	A4 01	1 120				DEOUIDEREDAS	420	
#FIDEORETER STEED: #FIDEORETER STEEDER: #FIDEORETER																		
#FEDIORYTE BUBBER: 15-1515	*]	HYDROME	TER TYPE:			152H				••••								
#RIASE BUBBER: 10									*******	**********	********					0.28		
#FLESH BUBBER: 1	2	BRAIRR	HOMBER:						*PART 6: S	IRTE ON FINE	FRACTION							
SPOINT NOT NOT NOT NOT NOT NOT NOT NOT NOT N	1]	FLASI H	DABEB:			1											_	
SPOINT NOT NOT NOT NOT NOT NOT NOT NOT NOT N	1	PECIFI	C GRAVITY	:		2.48			t	COMOLATIVE	PERCENT							
#BOTST WT. OF SOIL (g): 69.07  #CORRECTED DRI WT (g): 68.74  #EB: 1.00  # \$20 138.37  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033  #8.32 0.0033	\$	PORTION	TESTED:			-\$10			1									
### S	1	IOIST W	r. of soi	L (g):		69.07			1									
### 1.00						68.74			STARE (g)	102.83					*********	**********	*******	
### STREPS CORRECTION  ### STREPS CORRECTION  ### SEGO 154.60 10.112 0.0014 -0.43 ***  ### STREPS PRAD.  ### STREPS PRACTOR PRACTOR FACTOR	1	Ra:				1.00			# \$20	138.37	48.33	0.0033			<b>4</b> ]	NOTES:		
## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## STARP. BYAD.  ## BYAD.  ## STARP. BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.  ## BYAD.	13	STANDAR!	D SOLUTIO	8					1 140	156.35	22.1%	0.0023	0.4%		<b>*</b>			
### TEMP. PRAD.  ### 19.10 8.50  ### SCOOL FLAPSED  ### SCOOL FLAPSED  ### TIME TEMP. BYDRO CORR. FACTOR TAILER DEPTH (Tags) DIAM. Log TYOTAL  #### L.cm I (mm) DIAM. SAMPLE  #### L.cm I (mm) DIAM. SAMPLE  ###################################	17	ERO CO	RRECTION						<b>* #60</b>	164.60	10.1%	0.0014	-0.4%					
### 19.10 8.50 #### 25.70 6.00 ###################################										169.44	3.12	ŧ			1			
## 25.70 6.00    FLAPSED   TIME   TEMP.   STORE   CORR.   FACTOR															1			
TIME TESP. BTDBO CORR. FACTOR FACTOR THERE DEPTH (Tags) DIAM. Log TTOTAL L.cm I (mm) DIAM. SAMPLE  25 8 34 0 **********												********			**********	**********	*******	
## B S (min.) (C) READING (CONTROL) t a L.cm   L (mm) DIAM. SAMPLE  ### 25 8 34 0 ******** 1.00 22.1 8.0 7.36 0.40 1.03 1.6% 14.819 0.01332 0.0513 -1.29 1.30  ### 25 8 37 0 ******* 3.00 22.1 7.5 7.36 0.40 1.03 0.8% 14.901 0.01332 0.0297 -1.53 0.70  ### 25 8 42 0 ******* 20.00 22.1 7.5 7.36 0.40 1.03 0.8% 14.901 0.01332 0.0162 -1.74 0.70  ### 25 8 54 0 ******* 20.00 22.1 7.5 7.36 0.40 1.03 0.8% 14.901 0.01332 0.0162 -1.74 0.70  ### 25 9 34 0 ******* 20.00 22.1 7.5 7.36 0.40 1.03 0.8% 14.901 0.01332 0.0165 -1.94 0.70  ### 25 9 34 0 ******* 20.00 22.1 7.5 7.36 0.40 1.03 0.8% 14.901 0.01332 0.0165 -1.94 0.70  ### 25 9 34 0 ******* 20.00 22.1 7.5 7.36 0.40 1.03 0.2% 14.983 0.01332 0.0067 -2.18 0.20  ### 25 9 34 0 ******* 20.00 22.1 7.5 7.36 0.40 1.03 0.2% 14.983 0.01332 0.0067 -2.18 0.20  ### 25 9 34 0 ******* 20.00 22.1 7.5 7.36 0.40 1.03 0.2% 14.983 0.01332 0.0067 -2.18 0.20  ### 25 9 34 0 ******* 20.00 22.1 7.5 7.36 0.40 1.03 0.2% 14.983 0.01332 0.0067 -2.18 0.20  ### 25 9 34 0 **********************************			5.00				9822											
2 25 8 34 0 222222 1.00 22.1 8.0 7.35 0.40 1.03 1.61 14.819 0.01332 0.0513 -1.29 1.31 2.5 8 37 0 22222 8.00 22.1 7.5 7.36 0.40 1.03 0.81 14.901 0.01332 0.0297 -1.53 0.71 2.5 8 42 0 22222 8.00 22.1 7.5 7.36 0.40 1.03 0.82 14.901 0.01332 0.0182 -1.74 0.71 2.5 8 54 0 22222 2.00 22.1 7.5 7.36 0.40 1.03 0.82 14.901 0.01332 0.0182 -1.74 0.71 2.5 8 54 0 22222 2.00 22.1 7.5 7.36 0.40 1.03 0.82 14.901 0.01332 0.0182 -1.74 0.71 2.5 9 34 0 22222 2.00 22.1 7.5 7.36 0.40 1.03 0.82 14.901 0.01332 0.0115 -1.94 0.71 2.25 9 34 0 22222 2.00 22.1 7.5 7.36 0.40 1.03 0.82 14.901 0.01332 0.0015 -1.94 0.71 2.25 9 34 0 22222 2.00 22.1 7.5 7.36 0.40 1.03 0.22 14.983 0.01332 0.0067 -2.18 0.22 2.5 12 33 0 22222 2.00 22.4 7.0 7.25 0.40 1.03 0.22 14.983 0.01332 0.0067 -2.18 0.22 2.5 12 33 0 22222 2.00 22.7 7.0 7.14 0.40 1.03 0.42 14.983 0.01332 0.0033 -2.48 0.31 2.25 17 7 0 222222 513.00 22.9 7.0 7.06 0.40 1.03 0.51 14.983 0.01332 0.0023 -2.64 0.41 2.26 8 15 0 222221121.00 21.7 7.0 7.52 0.20 1.03 -0.51 14.983 0.01332 0.0023 -2.64 0.41 2.26 8 15 0 222221121.00 21.7 7.0 7.52 0.20 1.03 -0.51 14.983 0.01348 0.0014 -2.86 -0.41 2.26 2.66 8 15 0 222221121.00 21.7 7.0 7.52 0.20 1.03 -0.51 14.983 0.01348 0.0014 -2.86 -0.41 2.26 2.66 2.66 2.66 2.66 2.66 2.66 2.6												I PIRER						
2 25 8 34 0 ******* 1.00 22.1 8.0 7.36 0.40 1.03 1.6% 14.819 0.01332 0.0513 -1.29 1.3: 2 25 8 37 0 ******* 3.00 22.1 7.5 7.36 0.40 1.03 0.8% 14.901 0.01332 0.0297 -1.53 0.7: 2 25 8 42 0 ****** 8.00 22.1 7.5 7.36 0.40 1.03 0.8% 14.901 0.01332 0.0182 -1.74 0.7: 2 25 8 54 0 ****** 20.00 22.1 7.5 7.36 0.40 1.03 0.8% 14.901 0.01332 0.0182 -1.74 0.7: 2 25 9 34 0 ****** 60.00 22.4 7.0 7.25 0.40 1.03 0.8% 14.901 0.01332 0.0115 -1.94 0.7: 2 25 9 34 0 ****** 60.00 22.4 7.0 7.25 0.40 1.03 0.8% 14.901 0.01332 0.0067 -2.18 0.2: 2 25 12 33 0 ****** 239.00 22.7 7.0 7.14 0.40 1.03 0.2% 14.983 0.01332 0.0067 -2.18 0.2: 2 25 17 7 0 ******* 513.00 22.9 7.0 7.06 0.40 1.03 0.4% 14.983 0.01332 0.0033 -2.48 0.3: 2 26 8 15 0 ******* 513.00 22.9 7.0 7.06 0.40 1.03 0.5% 14.983 0.01332 0.0023 -2.64 0.4: 2 26 8 15 0 ******** 513.00 22.9 7.0 7.06 0.40 1.03 0.5% 14.983 0.01332 0.0023 -2.64 0.4: 3 27************************************			_								a		i,cr	I	(na)	DIAH.	SAMPLE	
## 25	1		£				*******					******						
## 25 8 37 0 ******* 3.00 22.1 7.5 7.36 0.40 1.03 0.8% 14.901 0.01332 0.0297 -1.53 0.7:  ## 25 8 42 0 ****** 8.00 22.1 7.5 7.36 0.40 1.03 0.8% 14.901 0.01332 0.0182 -1.74 0.7:  ## 25 8 54 0 ****** 20.00 22.1 7.5 7.36 0.40 1.03 0.8% 14.901 0.01332 0.0182 -1.74 0.7:  ## 25 9 34 0 ****** 60.00 22.4 7.0 7.25 0.40 1.03 0.8% 14.901 0.01332 0.0115 -1.94 0.7:  ## 25 12 33 0 ****** 239.00 22.7 7.0 7.14 0.40 1.03 0.2% 14.983 0.01332 0.0067 -2.18 0.2:  ## 25 17 7 0 ****** 513.00 22.9 7.0 7.06 0.40 1.03 0.4% 14.983 0.01332 0.0033 -2.48 0.3:  ## 26 8 15 0 ******* 513.00 22.9 7.0 7.06 0.40 1.03 0.5% 14.983 0.01332 0.0023 -2.64 0.4:  ## 26 8 15 0 ******* 513.00 22.9 7.0 7.06 0.40 1.03 0.5% 14.983 0.01332 0.0023 -2.64 0.4:  ## 26 8 15 0 ******* 513.00 21.7 7.0 7.52 0.20 1.03 -0.5% 14.983 0.01348 0.0014 -2.86 -0.42:  ## 27 **********************************	1		R		•		. 22 1	9 A	7 12	A 10	1 02	1 50	11 016	A 61990	A AE19	4 80	4 4.	
25 8 42 0 ****** 8.00 22.1 7.5 7.36 0.40 1.03 0.8% 14.901 0.01332 0.0182 -1.74 0.7:  25 8 54 0 ****** 20.00 22.1 7.5 7.36 0.40 1.03 0.8% 14.901 0.01332 0.0115 -1.94 0.7:  25 9 34 0 ****** 60.00 22.4 7.0 7.25 0.40 1.03 0.2% 14.983 0.01332 0.0067 -2.18 0.2:  25 12 33 0 ****** 239.00 22.7 7.0 7.14 0.40 1.03 0.4% 14.983 0.01332 0.0033 -2.48 0.3:  25 17 7 0 ****** 513.00 22.9 7.0 7.06 0.40 1.03 0.5% 14.983 0.01332 0.0033 -2.48 0.3:  26 8 15 0 ****** 15 0.00 22.9 7.0 7.06 0.40 1.03 0.5% 14.983 0.01332 0.0023 -2.64 0.4:  27 26 8 15 0 ****** 15 0.00 21.7 7.0 7.52 0.20 1.03 -0.5% 14.983 0.01348 0.0014 -2.86 -0.42  28 29 20 20 20 20 20 20 20 20 20 20 20 20 20	1		Ř															
## 25																		
2 25 9 34 0 22222 60.00 22.4 7.0 7.25 0.40 1.03 0.22 14.983 0.01332 0.0067 -2.18 0.22 25 12 33 0 22222 239.00 22.7 7.0 7.14 0.40 1.03 0.42 14.983 0.01332 0.0033 -2.48 0.32 25 17 7 0 22222 513.00 22.9 7.0 7.06 0.40 1.03 0.52 14.983 0.01332 0.0023 -2.64 0.42 26 8 15 0 222221421.00 21.7 7.0 7.52 0.20 1.03 -0.52 14.983 0.01342 0.0014 -2.86 -0.42 27 28 28 28 28 28 28 28 28 28 28 28 28 28			8															
2 25 12 33 0 ****** 239.00 22.7 7.0 7.14 0.40 1.03 0.4% 14.983 0.01332 0.0033 -2.48 0.3: 2 5 17 7 0 ****** 513.00 22.9 7.0 7.06 0.40 1.03 0.5% 14.983 0.01332 0.0023 -2.64 0.4: 2 6 8 15 0 ****** 1421.00 21.7 7.0 7.52 0.20 1.03 -0.5% 14.983 0.01348 0.0014 -2.86 -0.4:  ***********************************	1		9		-													
# 25 17 7 0 ****** 513.00 22.9 7.0 7.06 0.40 1.03 0.5% 14.983 0.01332 0.0023 -2.64 0.4: # 26 8 15 0 ******1421.00 21.7 7.0 7.52 0.20 1.03 -0.5% 14.983 0.01348 0.0014 -2.86 -0.4: # ************************************	1		-		-													
2 26 8 15 0 ******1421.00 21.7 7.0 7.52 0.20 1.03 -0.5% 14.983 0.01348 0.0014 -2.86 -0.42  ***********************************																		
### PROJECT: MORSANTO/RI/TS/ID  *PROJECT NUMBER: 913-1101  *TASK: 208 DATE: 11/21/91  *TECHNICIAN: MF REVIEWED BY: DOWN MASHINGTON	1		_	•														
*PROJECT: MOHSANTO/RI/FS/ID GOLDER ASSOCIATES INC.  *PROJECT NUMBER: 913-1101 TASK: 208 DATE: 11/21/91 GEOTECHNICAL TESTING LABORATORY  *TECHNICIAN: MF REVIEWED BY: DOWN MASHINGTON			-		-		1	•••		4.44	4.44	- 7.54	41.444	4.41940	4.4414	-2.00	-0.74	
*PROJECT: MOHSANTO/RI/FS/ID GOLDER ASSOCIATES INC.  *PROJECT NUMBER: 913-1101 TASK: 208 DATE: 11/21/91 GEOTECHNICAL TESTING LABORATORY  *TECHNICIAN: MF REVIEWED BY: DOWN MASHINGTON	11	*****	******	*****	*******	******	******	*******	********	*******	********	*********	********	******	**********	*******	*******	
*PROJECT RUMBER: 913-1101 TASK: 208 DATE: 11/21/91 GEOTECHNICAL TESTING LABORATORY *TECHNICIAN: MF REVIEWED BY: PROMOND, WASHINGTON	1P	ROJECT:																
*TECHNICIAN: MF REVIEWED BY: DOOD BEDWOOD, WASHINGTON	*P	ROJECT	NUEBER:	BR: 913-1101					TASE: 208 DATE: 11/21/91 GROTECHNICAL T					RATORY				
***************************************					M?				REVIEWED B	B <b>Y</b> :	DRA				REDMOND. WAS	HINGTON		
	**	******	*******	******	********	******	******	*******	********	*******		*******	********	******	*********	*********	*******	

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*WORKSHEET FOR MOISTURE CONTENT OF SOILS  ASTE D-2216 *WORKSHEET FOR SIETE AND HYDROMETER  ASTE D-422 (MODIFIED FOR TEMPERATURE CHARGE) *HORKSHEET FOR DRY PREPARATION OF SOILS  ASTE D-421 *UPDATED 3/20/90 BY D. OSTER	*PART A: HATURAL HOISTURE COHTERT*PA  *	ART C: FINE FRACTION HOISTURE *PART D: COARSE FRACTION HOISTURE  ARE 8: 1 *TARE 8: 5  ARE (g): 25.00 *TARE (g): 69.01  DIST NT. (g): 66.81 *HOIST NT. (g): 93.30  FER DRY NT (g): 56.74 *OVEN DRY NT (g): 93.24  X: 0.171*NX: 0.25X
*PART B:SEPARATION OF FRACTIONS  *WRIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 206.04  *WRIGHT OF AIR DRY TARE (g): 78.48  *WRIGHT OF -PIO TARE (g): 78.42  *WRIGHT OF -PIO FRACTION + TARE (g): 181.23  *WRIGHT OF -PIO FRACTION, AIR DRY (g): 102.81  *WRIGHT OF +PIO FRACTON, AIR DRY (g): 24.75  *OVER DRY WRIGHT OF FINES (g): 102.64  *OVER DRY WRIGHT OF COARSE FRACTION (g): 24.69  *OVER DRY WRIGHT OF TOTAL SAMPLE (g): 127.33	COMPLATIVE PERCENT :	FIBAL RESULTS
*PART F: HYDROMETER TEST ON FIRE FRACTION *	****** \$4 69.01 100.03* * \$10 91.97 82.03* * PAB 93.22 81.03*	######################################
*HYDROHETER TYPE: 152H *HYDROHETER HUBBER: 15-1515  FRAKER HUBBER: 18 *LASK HUBBER: 2 *SPECIFIC GRAVITY: 2.52 *PORTION TESTED: -#10 *HOIST WT. OF SOIL (g): 60.75 *CORRECTED DRY WT (g): 60.65 *Rm: 1.00 *STANDARD SOLUTION *IERO CORRECTION *IERO CORRECTION *IERO T.50 *TEMP. READ. *19.00 7.50	*PART G: SIEVE ON FIRE FRACTION :  CUMULATIVE PERCENT :  WEIGHT FINEE :  TARE (g) 70.06 :	\$200 1.1%
* 25.30 5.00 ELAPSED	IKRO CORR. CORR.	t t  REF. CORSTANT
* 25 8 45 0 ***** 0.00 * 25 8 46 0 ***** 1.00 22.3 * 25 8 48 0 ***** 3.00 22.3 * 25 8 53 0 ***** 8.00 22.3	DING (CONTROL) t a  6.5 6.19 8.40 1.03 6.0 6.19 8.40 1.03 6.0 6.19 0.40 1.03	0.4% 15.147 0.01332 0.0299 -1.52 0.31 0.4% 15.147 0.01332 0.0183 -1.74 0.31
<b>t</b>	6.0 6.23 0.40 1.03 6.0 6.19 0.40 1.03 6.0 6.03 0.40 1.03 6.0 5.99 0.40 1.03 6.0 6.43 0.20 1.03	0.3x 15.147 0.01332 0.0116 -1.94 0.22 0.4x 15.147 0.01332 0.0067 -2.17 0.33 0.6x 15.147 0.01332 0.0034 -2.47 0.53 0.7x 15.147 0.01332 0.0023 -2.64 0.61 -0.4x 15.147 0.01348 0.0014 -2.85 -0.33
*PROJECT: HORSANTO/RI/FS/ID *PROJECT HUMBER: 913-1101 *TECHNICIAR: MF	TASE: 208 DATE: 1: REFIERED BY: DO	GOLDER ASSOCIATES INC.  11/13/91 GEOTECHNICAL TESTING LABORATORY  REDMOND, WASHINGTOR

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11111111111111111111111111111111111111				
*HORKSHEET FOR HOISTURE CONTENT OF SOILS			THE SKECLION HOTPINKE	*PART D: COARSE FRACTION MOISTUR!
* ASTR D-2216	1	\$	••	1
*HORISHEET FOR SIEVE AND HYDROMETER	TARE :	24 *TARE 8:	20	*TARE 1: 26
* ASTH D-422 (HODIFIED FOR TEMPERATURE CHANGE)	*74RE (g):	25.01 *TARE (g):	24.86	*TARE (g): 76.34
	*HOIST WT. (g):	100.32 *BOIST WY.	(g): 64.43	*HOIST WT. (g): 98.81
* ASTM D-421	*OVER DRY WY (g):	96.55 *OVER DRY	WT (g): 64.24	*OVER DRY WT (g): 98.72
* UPDATED 3/20/90 BY D. OSTER	*# <b>%</b> :	5.271*W1:	0.48	X+WX: 0.40%
***************************************		**************	**********	*************
*PART B:SEPARATION OF FRACTIONS	*PART E: SIEVE OF COAR		NDF-1A	
1	*			
*WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 215.47	* COMOLATIVE	PERCENT #	FIRAL RESULTS	* SIZE OF MINIMUM MASS OF
*WEIGHT OF AIR DRY TARE (g): 78.48	* WEIGHT (g)			* LARGEST +\$10 PORTION
	\$			
*#EIGHT OF -\$10 TARK (g): 78.48 *#EIGHT OF -\$10 FRACTION + TARK (g): 192.64	*7ARE (g) 76.34	ŧ 3°	100.0%	1
-MAIDED OF -SIG FRACTION T TARK (8). 132.09			100.04	
*HEIGHT OF -\$10 FRACTION, AIR DRY (g): 114.16		100.0X* 2°	200.00	* 3° 5000g
*WEIGHT OF +\$10 FRACTOR, AIR DRY (g): 22.83	* 2° 76.34	100.01: 1	100.0%	* 2° 4000g
	* 1° 76.34	100.0%: 3/4"	•••••	1 2000g
TOTAL DRY WEIGHT OF COARSE FRACTION (g): 22.74	<b>3/4</b> 76.34	100.03* 3/8*	•••••	* 3/4° 1000g
*OVER DRY WEIGHT OF TOTAL SAMPLE (g): 136.35	<b>*</b> 3/8° 75.34	100.01: \$4	100.03	* 3/8" 500g
***************************************		100.01	*****	•
*PART F: HYDROMETER TEST OR FINE FRACTION	<b>\$10</b> 98.12	84.01: \$20	40.6%	*MEETS ASTH REQUIREMENT? YES
1	* PAB 98.74	83.6% \$40	18.6%	*********************
*HYDROMETER TYPE: 152H	*	* \$60		t
≠HYDROMETER MUMBER: 15-1515	****************	********* \$100	2 2.	* D10: 0.28
	*PART G: SIETE ON FINE			* D30: 0.69
	1	* 0.0513		* D60: 1.20
*SPECIFIC GRAVITY: 2.48	* COMULATIVE			* Cu: 4.29
*PORTION TESTED: -\$10	* WEIGHT	FIRER # 0.0182		2 Cz: 1.41
*HOIST WY. OF SOIL (g): 69.07	\$			*
*CORRECTED DRY NT (g): 68.74		* ******		
*Ra: 1.00	*TARE (g) 102.83	* 0.0067		***************************************
<del></del>	<b>*</b> \$20 138.37	48.3X* 0.0033	****	* NOTES:
	<b>* #40</b> 156.35	48.3% 0.0033 22.1% 0.0023 10.1% 0.0014		*
			-0.4%	*
	* \$100 169.44	3.1%		*
	<b>* #200</b> 170.87	1.0%		t
		**************	************	************
* 25.70 6.00 ELAPSED	ZERO CORR.	CORR.	EFF. CORSTANT	
# TIME TEMP. HYDRO	CORR. FACTOR	PACTOR I FINER	DEPTH (TåGs)	DIAH. LOG TTOTAL
*D HR H S (min.) (C) READING	(CONTROL) t	a	L.cz I	(mm) DIAM. SAMPLE
***************************************				
± 25 8 34 0 ***** 0.00				
* 25 8 35 0 ***** 1.00 22.1 8.0	7.36 0.40	1.03 1.53	14.819 0.01332	0.0513 -1.29 1.3
<b>25</b> 8 37 0 ****** 3.00 22.1 7.5	7.36 0.40	1.03 0.83		0.0297 -1.53 0.7
* 25 8 42 0 ***** 8.00 22.1 7.5	7.36 0.40	1.03 0.82		0.0182 -1.74 0.7:
* 25 8 54 0 ***** 20.00 22.1 7.5	7.36 0.40	1.03 0.83		0.0115 -1.94 0.7:
25 9 34 0 ****** 60.00 22.4 7.0	7.25 0.40	1.03 0.23		0.0067 -2.18 0.21
± 25 12 33 0 ***** 239.00 22.7 7.0	7.14 0.40	1.03 0.43		
25 17 7 0 ****** 513.00 22.9 7.0				
	7.05 0.40	1.03 0.53		0.0023 -2.64 0.41
26 8 15 0 ******1421.00 21.7 7.0	7.52 0.20	1.03 -0.53	14.983 0.01348	0.0014 -2.86 -0.41
•	••••••		*****	
######################################	***************************************	***************************************		
*PROJECT: MORSANTO/RI/FS/ID	T187 111	N188 44.84.***		GOLDER ASSOCIATES INC.
*PROJECT NUMBER: 913-1101	TASI: 208	DATE: 0 3 11/21/91		SPOTECHNICAL TESTING LABORATORY
*TECHRICIAE: MF	REVIEWED BY:	DPO		REDMOND, WASHINGTON
***************************************	*****************	***************	***********	***********************************

## APPENDIX B-2 PHASE II SAMPLES

### SCHEDULE OF LABORATORY TESTS

PROJE	CT TITLE	<b>:</b>	_	Ν	(v	۸5،	٩٨	<del> </del> 0				_	/_	R	I	F	5		To	کد	4	ds	>	_	/_	רו	<u>D</u>	
PROJE	CT NUM	BER	-	۱ إ	13	-1	10	1			٠.	6	01	_							AC	TE	E 1	N			12-17-92	
ENGR.						M	GF	₹.	•	B	a,	to	′Λ							ב	AC	TE	E [	)U	E			İ
			, ,										_		·			_				20						_
			I I	S		#200 Wash only	Sieve	Y	ŏ	٥	-	UO	eldm	¥9	plait					œ.		Description & USCS		١		ntent		
			Moisture Content	Atterberg Limits	Sieve, Washed	h on	er &	Specific Gravity	Modified Proctor	Proc	Unit Weight	Shelby Extrusion	Recompact Sample	Permeability, Flex	Permeability, Rigld	ation	ılat	rlal	lal	Unconfined Comp.	Bar	on &		Slake Durability	<u> </u>	Carbonate Content		
	<u> </u>	 	ture	rberg	9, Wa	) Was	rome	) )     	peiji	dard	Weig	by E	ошра	neap	neab	Consolidation	<b>UU-Trlaxlal</b>	CU-Triaxial	CD-Triaxial	outh	Vane Shear	cripti	-	OD ex	Desiccation	bona	COMMENTS	
BORING	SAMPLE	DEPTH	Mois	Alle	Siev	#200	Hyd	Spe	Mod	Star	5	She	<b>P</b>	Per	Peri	Con	ΩΩ	O)	Ċ	5	Van	Des	CBR	Slal	Des	Š	COMMENTS	
	Quartzite																											
	Haul Road			_	_		شرة		_	_	H	H	-	_							H		d	11	16	-	r's Copy	_
	West Service Road																						Š				- COPJ,	
	Ore																											
	Haul Road	1		_		-				_	L	_	-								_			_		_		
	Slag Havi Road						1.7																			_		
	East Service Road																											
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include	re content an id with Atterb e analysis.							SI	art	eđ				C	oml	olei	ted			Di	stri	ibut	ted			В	iled	

### GOLDER ASSOCIATES INC., REDMOND, WA

### SUMMARY OF MOISTURE CONTENT (ASTM D-2216) AND SPECIFIC GRAVITY (ASTM D-854)

PROJECT:

MONSANTO/RI/FS ROADS/ID

PROJ. NO:

913-1101.601

DATE:

1-26-93

TECH:

MF

REVIEW:

DPO

SAMPLE ID	MOISTURE CONTENT (%)	SPECIFIC GRAVITY
Quartzite Haul Road	11.4	2.62
West Service Road	10.5	2.76
Ore Haul Road	12.0	2.71
Slag Haul Road	-	2.71
East Service Road	-	2.71

WORKSHEET FOR HYDROMETER AND SIEVE	PARTA: N	ATURAL M	OISTURE	PART C: -#	#10 MOISTU	JRE	PART D:	##10 MOISTURE	
ASTM (MODIFIED FOR TEMPERATURE CHANGE)		_					i		
WORKSHEET FOR DRY PREPARATION OF SOILS	TARE #:			TARE #:		62	TARE #:	342	
ASTM D-421	TARE (g):	F	0.00	TARE (g):		31.30	TARE (g):	73.11	
WORKSHEET FOR MOISTURE CONTENT OF SOILS	MOIST WT.	(e): t	0.00	MOIST WT	. (g):	103.63	MOIST WI	r. (g): 574.28	1 1
	OVEN DRY		0.00	OVEN DRY		102.14	OVEN DR	Y WT (g): 571.69	1
ASTM D-2216	W%:	(8). L		W%:	- 10/	2.1%	W%:	0.5%	,
UPDATED 11/26/91 BY D. OSTER	PART E: SI	EVE OF 14	10						
PART B: SEPARATION OF FRACTIONS	ARTE. 31	EVE OI IN		FINAL R	ESULTS	BOR	ING:	East Service	
1(2400)		CUM	PERCENT	l mark	ESSEIS		3-	Road	
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 1624.90		WEIGHT	FINER	GRAIN F	PEDCENT	DEP			- 1
WEIGHT OF AIR DRY TARE (g):		WEIGHT	FINER	SIZE	FINER	DLi	L		Į.
WEIGHT OF -#10 TARE (g): 276.21		70.10		SIZE	LINEK				- 1
WEIGHT OF -#10 FRACTION + TARE (g): 1123.73	TARE (g)	73.13	100.00		100.00	COL	OP.		J
WEIGHT OF -#10 FRACTION, AIR DRY (g): 847.52	3"	73.13	100.0%	3"	100.0%		rish brown (5 \	/B 2/2)	1
WEIGHT OF +#10 FRACTON, AIR DRY (g): 501.17	2"	73.13	100.0%	2"	100.0%	Uray	isn brown (3	I K 3/2),	ן י
OVEN DRY WEIGHT OF FINES (g): 830.06	1"	73.13	100.0%	1"	100.0%		an inmai		ı
OVEN DRY WEIGHT OF COARSE FRACTION (g): 498.58	3/4"	82.24	99.3%	3/4"	99.3%		CRIPTION:	1.	,
OVEN DRY WEIGHT OF TOTAL SAMPLE (g): 1328.64	3/8"	181.83	91.8%	3/8"	91.8%		AND, some si		]
	#4	340.02	79.9%	#4	79.9%	some	e f gravel, (SM	)	J
PART F: HYDROMETER TEST ON FINE FRACTION	#10	504.91	67.5%	#10	67.5%		_		ı
				#20	54.9%		USCS:	SM	
HYDROMETER TYPE: 152H				#40	47.6%				Ì
HYDROMETER NUMBER: 15-1515				#60	42.4%				
	PART G: S	IEVE OF -#	10	#100	35.1%		LL:		1
	171111 0. 0	.2.201 "		#200	24.8%		PL:		
1 2 1011 1011 1011		CUM	PERCENT	0.0471	16.5%		Pl:		
	<u> </u>	WEIGHT	FINER	0.0281	11.6%			<del></del>	
PORTION TESTED: -#10		WEIGHT	INCK	0.0175	8.6%	ŀ			
MOIST WT. OF SOIL (g): 69.41	TABE	78.52		0.0173	6.7%	1	D10:	N/A	
CORRECTED DRY WT (g): 67.98	TARE (g)		81.4%	0.0065	4.8%	]	D30:	N/A	
Rm: 1	#20	91.18		0.0037	4.5%		D60:	N/A	
	#40	98.57	70.5%	11		Į.	Cu:	N/A	
TEMP. READ.	#60	103.78	62.8%	0.0023	3.1%	ļ	1		
STANDARD SOLUTION 19.4 8.0	#100	111.11	52.1%	0.0014	2.2%		Cz:	N/A	
ZERO CORRECTION 27.0 6.0	#200	121.48	36.8%	1					
	<u> </u>			<u> </u>		<u> </u>			
ELAPSED	ZERO	CORR.	CORR.		EFF.	CONSTANT	~	too errore	
TIME TEMP. HYDRO	CORR.	FACTOR	FACTOR	% FINER		(T&Gs)	DIAM.	LOG %TOTA	
D HR M S (min.) (C) READING	(CONT.)	t			L,cm_	<u> </u>	(mm)	DIAM SAMPL	<u> </u>
27 9 38 0 0.0									_
27 9 39 0 1.0 21.7 24.0	7.4	0.2	1.0	24.4%	12.195	0.01348	0.0471	-1.33 16.59	
27 9 41 0 3.0 21.7 19.0	7.4	0.2	1.0	17.2%	13.015	0.01348	0.0281	-1.55 11.69	
27 9 46 0 8.0 21.7 16.0	7.4	0.2	1.0	12.8%	13.507	0.01348	0.0175	-1.76 8.6%	
27 9 58 0 20.0 21.8 14.0	7.4	0.2	1.0	9.9%	13.835	0.01348	0.0112	-1.95 6.7%	
27 10 38 0 60.0 21.9 12.0	7.3	0.2	1.0	7.1%	14.163	0.01348	0.0065	-2.18 4.89	6
27 12 38 0 180.0 22.1 11.5	7.3	0.4	1.0	6.7%	14.245	0.01332	0.0037	-2.43 4.59	
27 17 38 0 480.0 22.3 10.0	7.2	0.4	1.0	4.6%	14.491	0.01332	0.0023	-2.64 3.19	6
28 9 39 0 1441.0 21.6 9.5	7.4	0.2	1.0	3.3%	14.573	0.01348	0.0014	-2.87 2.29	6
20 7 37 V 1441.0 21.0 7.3		J.2		2.270		•			
PROJECT: MONSANTO/ RI/ FS ROADS/ ID						GO	LDER ASSO	CIATES INC.	
1	DATE:		1-29-92					L TESTING LABORATO	RY
PROJECT NUMBER: 913-1101.601		ED DV.	DPO				DMOND, WA		-
TECHNICIAN: MF/BA	REVIEW	EDBI:	DIO			NC1	חזיי ,עייטיייכ		

'n

WORKS	ICCT CO	מעט מו	DOMETE	R AND SIEV	/F		PART A. N	IATURAL N	OISTURE	PART C: -	#10 MOIST	URE	PART D:	+#10 MOIS	TURE	
WORKS	TEELFU	JK TLLU 422 /NAC	VOMETE VOMETE	FOR TEMPE	RATIE	CHANGE)					· · ·				_	
WORKS	TEET CO	אנג (MI) ממין מר	DDEDYD	ATION OF S	ani e	_ CLD 1110L)	TARE #:		23	TARE #:		11	TARE #:		Γ	ОН
1 '			rkerak	ATION OF 3	سان		TARE (g):		76.94	TARE (g):		25.18	TARE (g	):		75.97
	ASTM D-		THE C	ONTENT OF	COILC		MOIST WI	(a).	770.11	MOIST W		90.18	MOIST V			534.44
i			STURE	ONTENT OF	30163		OVEN DR		704.42	OVEN DR		89.60		RY WT (g):		532.79
	ASTM D			O COURTED			W%:	1 44 1 (R).	10.5%	W%:	(g).	0.9%	W%:	(6)	_	0.4%
			91 BY D.		<del></del>			IEVE OF +		1 70.		1				
PART B:	SEPARA	ATION C	)F FRAC	11002			TARLE: 3	IEVE OF T	710	FINAL I	RESULTS	BC BC	ORING:	West Service	e 7	
					1	1252.10		CIN	PERCENT	l livae	RESCEIG		MPLE:	Road		
I .				E, AIR DRY	(g):	1263.10			FINER	GRAIN	PERCENT		EPTH:	TOBU		
WEIGHT					į	254.04		WEIGHT	FINER	SIZE	FINER	1	Cr III.	L		
WEIGHT						254.04		75.00	ı	SIZE	LINEK					
WEIGHT	OF -#10	0 FRAC	T + 4011	ARE (g):		804.63	TARE (g)	75.98			100.00		OLOR:			
WEIGH1	OF -#1	0 FRAC	ΓΙΟΝ, ΑΙΙ	R DRY (g):		550.59	3"	75.98	100.0%	3"	100.0%			/2\		<del></del> -
WEIGHT	OF +#	10 FRAC	TON, All	R DRY (g):		458.47	2"	75.98	100.0%	2"	100.0%		live gray (5 Y 3	/2),		
OVEN D						545.68	1"	110.60	96.5%	1"	96.5%	<u> </u>	naan intio:			
OVEN D	RY WEI	GHT OF	COARS	E FRACTION	l (g):	456.82	3/4"	110.60	96.5%	3/4"	96.5%		ESCRIPTION:			
				SAMPLE (g):		1002.50	3/8"	187.84	88.8%	3/8"	88.8%	4	SAND, some	c-f gravel,		}
							#4	351.11	72.6%	#4	72.6%	so	me silt, (SM).			
PART F:	HYDRO	OMETE	R TEST O	N FINE FRA	CTION		#10	509.88	56.7%	#10	56.7%					
								·		#20	44.8%	1	USCS:	SM		
HYDRO	METER	TYPE		152H						#40	37.2%					
HYDRO			R.	15-1515						#60	31.6%	[				
BEAKER				1 1			PART G: S	SIEVE OF -#	<b>⊭10</b>	#100	24.3%	İ	LL:			
FLASK N				3						#200	17.1%	1	PL:			
1				2.76			Í	CUM	PERCENT	0.0479	11.6%	1	PI:			
SPECIFIC				-#10			1	WEIGHT	FINER	0.0284	8.0%	ł				
PORTIO				68.46			i	Bioiii		0.0176	6.3%	1				
MOIST V		10,					TARE (g)	77.93	1	0.0112	5.1%		D10:	N/A		
CORRE	CIED D	KY WI (	g):	67.85			#20	92.17	79.0%	0.0065	4.0%		D30:	N/A		
Rm:				1			#40	101.31	65.5%	u	3.4%	ŀ	D60:	N/A		
								107.98	55.7%	22	2.6%		Cu:	N/A		
Ì				TEMP.	READ.	1	#60		4	H	2.0%		Cz:	N/A		
STANDA				19.4	8.0	ļ	#100	116.76	42.8%		2.276		CZ.	1971		
ZERO C	ORREC	TION		27.0	6.0	<b>J</b>	#200	125.28	j 30.2%							
									0022	Ļ	11-14	CONSTANT				
				ELAPSED			ZERO	CORR.	CORR.	~	EFF.				100	%TOTAL
				TIME		HYDRO	CORR.		FACTOR	% FINER		(T&Gs)	DIAM.			SAMPLE
D	HR	M	S	(min.)	(C)	READING	(CONT.)	t	a		L,cm	K	(mm)		DIAM	AMILE
27	9	5	0	0.0					_		40			•	1 22	11 607
27	9	6	0	1.0	21.4	21.5	7.5	0.2	1.0	20.5%		0.01348	0.0479		-1.32	11.6%
27	9	8	0	3.0	21.4		7.5	0.2		14.0%		0.01348	0.0284		-1.55	8.0%
27	9	13	0	8.0	21.5		7.4	0.2		11.2%		0.01348	0.0176		-1.75	6.3%
27	ģ	25	0	20.0	21.6	13.5	7.4	0.2	1.0	9.1%	13.917	0.01348	0.0112		-1.95	5.1%
27	10	5	0	60.0	21.8	12.0	7.4	0.2	1.0	7.0%	14.163	0.01348	0.006		-2.18	4.0%
27	12	5	Õ	180.0	22.1	11.0	7.3	0.4	1.0	5.9%	14.327	0.01332	0.003	8	-2.43	3.4%
27	17	5	0	480.0	22.3		7.2			4.6%		0.01332	0.002	3	-2.64	2.6%
28	9	5	0	1440.0	21.2		7.5			3.9%		0.01348	0.001		-2.87	2.2%
1 20	y	J	v	1440.0		1 10.0	,.5	7.2		2 /**	<u>-</u>					
-																
PROJEC	<b>~T</b> r.		MONGAN	TO/RI/FSR	OADS/II	D						G	OLDER ASSO	OCIATES IN	C.	
PROJEC			913-1101.6		CADS/ II	_	DATE:		1-29-92				EOTECHNIC			RATORY
		_ `	913-1101.0 MF/BA	/V I			REVIEW	ÆD BY:	D			_	EDMOND, W			
TECHN	ICIA		MIL/DW				1/2/7/201									

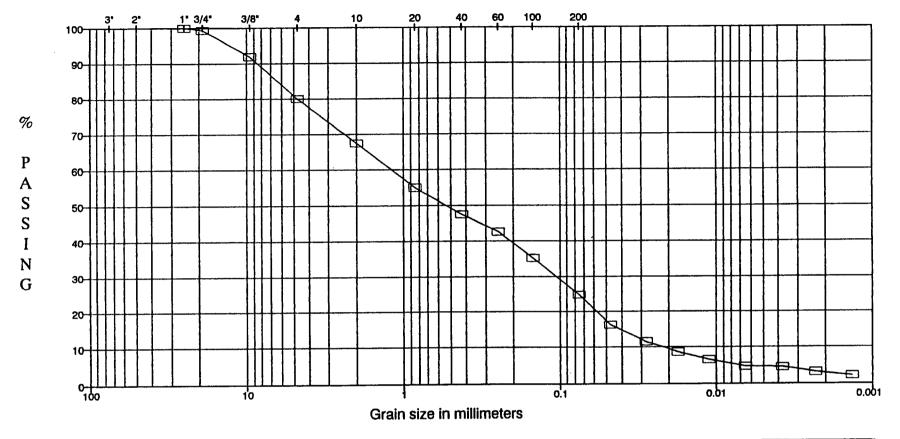
									LO LOTT IDE	DADTO	*10 NOIST	IDE	PARTO	+#10 MOIS	riige	1
WORKSI	HEET P			ER AND SIEV			PART A: N	NATURAL M	OSTIRE	PART C: -	#10 MO12 1 1	UKE	TAKI D.	+#10101013	IONL	
	<b>ASTM</b>			FOR TEMPE		CHANGE)		г		E.D.C. "		70)	TARE #:			S-I
WORKSI	HEET FO	JR DR	Y PREPAR	RATION OF S	OILS		TARE #:	į.	N. S.	TARE #:		20 21.82	1	_	-	70.09
F	ASTM D	421					TARE (g):	]	64.87	TARE (g):			TARE (g):		<b>⊢</b>	
WORKSI	HEET FO	OR MO	ISTURE C	ONTENT OF	SOILS		MOIST WI	ſ. (g):	786.57	MOIST WT		88.19	MOIST W			369.91
A	ASTM D	2216					OVEN DR	Y WT (g):	712.98	OVEN DR'	Y WT (g):	87.49	1	RY WT (g):	L	369.90
ι	JPDATE	D 11/2	6/91 BY D.	OSTER	_		W%:		11.4%	W%:		1.1%	W%:			0.0%
			OF FRAC				PARTE: S	IEVE OF +	<b>#10</b>			ļ		<del></del>		
									1	FINAL P	RESULTS	1	ORING:	Quartzite		
WEIGHT	TOTAL	SAMP	LE + TAR	RE, AIR DRY	(g):	1028.20		CUM	PERCENT				MPLE:	Haul Road		
			TARE (g):	- <b>-,</b>	``'	190.81		WEIGHT	FINER	GRAIN I	PERCENT	DI	EPTH:			
WEIGHT			10.		Ì	190.81		•		SIZE	FINER					
			TION + I	TARE (a):	ł	734.60	TARE (g)	70.08				1				
					ı	543.79	3"	70.08	100.0%	3"	100.0%		DLOR:			
				R DRY (g):		293.60	2"	70.08	100.0%	2"	100.0%	D	ısky yellowish b	rown (10 YR	2/2),	
				R DRY (g):		538.05	1"	70.08	100.0%	1"	100.0%	i -				
			F FINES (		•	293.59	3/4"	70.08	100.0%	3/4"	100.0%	l Di	ESCRIPTION:			
				E FRACTION			4	116.72	94.4%	3/8"	94.4%		SAND, some s	ilt.		
OVEND	RY WEI	GHT O	FTOTAL	SAMPLE (g):		831.64	3/8"		84.9%	#4	84.9%		me f gravel, (SN			
							#4	195.38	69.3%	#10	69.3%	1	me i graven, (or.			
PART F:	HYDRO	DMETE	ER TEST C	ON FINE FRA	CTION		#10	325.50	09.3%		60.6%		USCS:	SM		
										#20	55.4%	l	0363.			
HYDRO	METER	TYPE:		152H			ļ			#40		j				
HYDRO	METER	NUMB	ER:	15-1515						#60	46.0%	]	LL:			
BEAKER	R NUMB	ER:		3			PART G:	SIEVE OF -#	10	#100	27.9%					
FLASK N	NUMBER	₹:		2						#200	18.2%	i	PL:	<b> </b>		
SPECIFI	C GRAV	'ITY:		2.62			1		PERCENT	0.0479	14.6%	ł	PI:	لــــا		
PORTIO	N TEST	ED:		-#10			İ	WEIGHT	FINER	0.0281	12.0%	j				
MOIST V	WT. OF S	OIL (g	):	68.67			İ			0.0175	9.4%	Ĭ				
CORRE			•	67.95			TARE (g)	65.55	l .	0.0111	7.9%	1	D10:	N/A		
Rm:			(6)	1			#20	74.08	87.4%	0.0065	7.0%	1	D30:	N/A		
1							#40	79.21	79.9%	0.0037	5.8%		D60:	N/A		
1				TEMP.	READ.		#60	88.39	66.4%	0.0023	4.8%		Cu:	N/A		
STANDA	4 P D SOI	UTIO	N	19.4	8.0	ì	#100	106.16	40.2%	0.0013	3.8%	!	Cz:	N/A		
ZERO C				27.0	6.0		#200	115.61	26.3%			1				
ZERUC	OKKEC	11011		27.0	0.0	•		L	,			1				
ļ				ELAPSED			ZERO	CORR.	CORR.	( <del> </del>	EFF.	CONSTANT				
				TIME	TEMP	HYDRO	CORR.		FACTOR	% FINER	DEPTH	(T&Gs)	DIAM.		LOG 9	<b>STOTAL</b>
, n	HR	M	s	(min.)	(C)	READING	(CONT.)	t	8		L.cm	` K ´	(mm)	3	DIAM S	AMPLE
D	nk	141		(63111.)	(0)	REFERENCE	(00)									
77	0	54	0	0.0												
27	8			1.0	21.3	21.5	7.5	0.2	1.0	21.0%	12.605	0.01348	0.0479		-1.32	14.6%
27	8	55			21.3	19.0	7.5		1.0	17.3%	13.015	0.01348	0.0281		-1.55	12.0%
27	8	57	0	3.0	21.3	16.5	7.5		1.0	13.6%		0.01348	0.0175		-1.76	9.4%
27	9	2	0	8.0		15.0	7.5 7.5		1.0	11.4%		0.01348	0.0111		-1.95	7.9%
27	9	14	0	20.0	21.4				1.0	10.1%		0.01348	0.0065		-2.19	7.0%
27	9	54	0	60.0	21.8	14.0	7.4			8.3%		0.01348	0.0037		-2.43	5.8%
27	11	54	0	180.0	22.1	12.5	7.3		1.0			0.01332	0.0037		-2.64	4.8%
27	16	54	0	480.0	22.2	11.5	7.3		1.0	6.9%			0.0023		-2.87	3.8%
28	8	54	0	1440.0	21.2	11.0	7.5	0.2	1.0	5.4%	14.327	0.01348	0.0013	•	-6.01	3.070
						.,							<del></del>			
												_	OI DED ASSO	CIATES INC		
PROJEC	CT:		MONSA	<b>NTO/ RI/ FS P</b>	ROADS/ II	)							OLDER ASSO			DATODV
PROJEC	CT NUM	BER:	913-1101.	601			DATE:		1-29-92				EOTECHNIC			LW I OK I
TECHN	ICIAN:		MF/BA				REVIEV	VED BY:	DPO			R	EDMOND, WA	ASHING I OF	<u>-</u>	

				TOD AND OUT	/F		DADTAL	IATUDAI N	MOISTURE	PART C: -#	10 MOISTI	JRE	PART D:	+#10 MOIS	TURE	
WORKSE	HEET FO	R HYD	ROMET	ER AND SIEV	/E	CHANCE	5	WIOKALI	MOISTORE	IANI C. T						_
				FOR TEMPE		CHANGE)	TARE #:		S-37	TARE #:		36	TARE #:	;	Γ	24
			PREPA	RATION OF S	OILS		1		74.45	TARE (g):		25.14	TARE (g			75.91
	ASTM D-						TARE (g):	Γ (-).	598.77	MOIST WI	(a)·	108.80	MOIST V	•	<u> </u>	571.94
			STURE	CONTENT OF	SOILS		MOIST WI	107	542.63	OVEN DRY		106.86	a a	RY WT (g):		567.64
	ASTM D-						OVEN DR	I W I (g):	12.0%	W%:	· · · · (B)·	2.4%	W%:	- <b>(B)</b>	_	0.9%
L	JPDATE	D 11/26	/91 BY D	OSTER				IEVE OF +		, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				<del></del>		<del></del>
PART B:	SEPARA	ATION	OF FRA	CTIONS			PARIE: 3	IEVE OF T	#10	FINALE	ESULTS	BC	RING:			
						140610	•	CUM	PERCENT		LOODIO	I -	MPLE:	Ore Haul R	oad	
				RE, AIR DRY	(g):	1406.10	1	WEIGHT	FINER	GRAIN I	PERCENT	4	EPTH:			
WEIGHT	OFAIR	DRY	TARE (g)	):		197.92		WEIGHT	PINER	SIZE	FINER		<i>.</i>			
WEIGHT						197.92	l	75.01	1	SIZE	PINER					
				TARE (g):		910.07	TARE (g)	75.91	100.00	1 2"	100.0%		DLOR:			
				IR DRY (g):		712.15	3"	75.91	100.0%	3"	100.0%		isky brown (5	YR 2/2)		
				IR DRY (g):		496.03	2"	75.91	100.0%	2"	100.0%	1	isky orowii (3	11(42),		
OVEN D	RY WEI	GHT O	F FINES	(g):		695.64	1"	75.91	100.0%	N .	96.1%	DI	SCRIPTION			
				SE FRACTION		491.73	3/4"	122.72	96.1%	II.			SAND, some		·····	
				L SAMPLE (g)		1187.37	3/8"	182.71	91.0%	3/8"	91.0%	1 1	SAND, some me c-f gravel, (			
							#4	321.86	79.3%	II.	79.3%	l so	me c-i gravei, i	(3141).		
PART F:	HYDRO	OMETE	R TEST	ON FINE FRA	CTION		#10	475.08	66.4%	n	66.4%		USCS:	SM		
							1			#20	57.8%	1	USCS:	J		
HYDRO	METER	TYPE:		152H						#40	51.3%					
HYDRO	METER	NUMB	ER:	15-1515			ł			#60	43.9%		LL:			
BEAKER	R NUMB	ER:		4			PART G:	SIEVE OF -	#10	#100	31.7%	Ì	PL:	1		
FLASK N	NUMBER	₹:		4			Ĭ			#200	22.0%		PI:			
SPECIFIC	C GRAV	'ITY:		2.71			ł	CUM	PERCENT	0.0468	17.2%	}	rı;			
PORTIO	N TESTI	ED:		-#10			1 .	WEIGHT	FINER	0.0277	13.4%	1				
MOIST V	WT. OF S	OIL (g)	:	69.15			1		_	0.0172	11.4%	ł	D10:	N/A		
CORREC	CTED D	RY WT	(g):	67.55			TARE (g)	78.46		0.0110	9.5%			N/A		
Rm:				1			#20	87.20	-1	II .	7.6%	1.	D30:	N/A		
ļ							#40	93.81	4	11	6.9%	1	D60:	N/A		
1				TEMP.	READ.	_	#60	101.34	_	III .	5.5%		Cu:			
STANDA	ARD SOI	LUTIO	N	19.4	8.0	]	#100	113.76		III	4.6%	1	Cz:	N/A		
ZERO C	ORREC	TION		27.0	6.0	}	#200	123.67	33.1%	H		1				
							1			_L	- FEE	L CONSTANT				
	<del></del>			ELAPSED			ZERO	CORR.	CORR.	~	EFF.		DIAM		LOG 9	%TOTAL
ļ				TIME	TEMP.	HYDRO	CORR.		FACTOR	% FINER	_	(T&Gs)		•		SAMPLE
D	HR	M	S	(m <u>in.)</u>	(C)	READING	(CONT.)	<u> </u>	a		L,cm	K	(mm)		DIAM	MINI CC
27	9	16	0	0.0		<del>,</del>				2/ 2~	12.021	0.01240	0.046	Q	-1.33	17.2%
27	9	17	0	1.0	21.5		7.4			26.0%		0.01348			-1.56	13.4%
27	9	19	0	3.0	21.5		7.4			20.1%	12.687	0.01348	0.027		-1.76	11.4%
27	9	24	0	8.0	21.5		7.4			17.2%	13.015	0.01348	0.017		-1.76 -1.96	9.5%
27	9	36	0	20.0	21.6	17.0	7.4			14.3%	13.343	0.01348	0.011		-1.90 -2.19	7.6%
27	10	16	0	60.0	21.8		7.4			11.5%		0.01348	0.006			
27	12	16	0	180.0	22.1	14.0	7.3			10.4%		0.01332	0.003		-2.43	6.9%
27	17	16	0	480.0	22.3	12.5	7.2	2 0.4		8.3%		0.01332	0.002		-2.64	5.5%
28	9	16	0	1440.0	21.4	12.0	7.5	5 0.2	2 1.0	6.9%	14.163	0.01348	0.001	.3	-2.87	4.6%
		<u> </u>						<del></del>					OLDER ASS	OCIATES IN	ıc	
PROJEC	CT:		MONSA	anto/ri/fs i	ROADS/I	D			4				EOTECHNIC			RATORY
	CT NU <u>M</u>	BER:	913-110	1.601			DATE:		1-29-92				EDMOND, V			
TECHN			MF/BA				REVIE	WED BY:	D.			K	EDMOND, W	ASIMOIC		

WORKSHEET R HY	DROMETI	ER AND SIEV	Æ		PART A: N	IATURAL N	10ISTURE	PART C: -	#10 MOIST	JRE	PART D:	+#10 MOIS	TURE	
ASTI 22 (N	ODIFIED	FOR TEMPE	RATURE	CHANGE)		•							_	
WORKSHEET FOR DR				1	TARE #:			TARE #:		9	TARE #:		<u> </u>	
ASTM D-421				ļ	TARE (g):		0.00	TARE (g):		25.03	TARE (g)	:	L	73.73
WORKSHEET FOR MC	VICTURE C	ONTENT OF	SOUS		MOIST WI	`. (g):	0.00	MOIST W	Γ. (g):	105.30	MOIST W	T. (g):		948.50
ASTM D-2216	/ISTORE C	ONTENT OF	JUILO		OVEN DR		0.00	OVEN DR	Y WT (g):	102.47	OVEN DE	RY WT (g):		939.50
UPDATED 11/2	26/01 RV D	OSTER			W%:	(8)		W%:		3.7%	W%:			1.0%
PART B: SEPARATION						IEVE OF +	#10							
TAKI B: SEFARATION	OFTIME	110113						FINAL	RESULTS	ВО	RING:			
WEIGHT TOTAL SAM	DIE + TAE	E AID DDV	(a): [	1752.90		CUM	PERCENT			SA	MPLE:	Slag Haul R	oad	1
		CE, AIR DR I	(g).	320.58		WEIGHT	FINER	GRAIN	PERCENT	DE	PTH:			
WEIGHT OF AIR DRY			ŀ	320.58				SIZE	FINER					
WEIGHT OF -#10 TAR		CARE (-).	ŀ	878.13	TARE (g)	107.69								
WEIGHT OF -#10 FRA			L	557.55	3"	107.69	100.0%	3"	100.0%	со	LOR:			
WEIGHT OF -#10 FRA				874.77	2"	107.69	100.0%	2"	100.0%	Me	dium dark gra	y (N4),		
WEIGHT OF +#10 FRA				537.89	1"	107.69	100.0%	1"	100.0%					
OVEN DRY WEIGHT			17-7-	865.77	3/4"	144.02	97.4%	3/4"	97.4%	DE	SCRIPTION:			
OVEN DRY WEIGHT					3/8"	403.69	78.9%	3/8"	78.9%	c-f	SAND and f G	RAVEL,		
OVEN DRY WEIGHT (	JF TOTAL	SAMPLE (g):	<del>:</del>	1403.66	3/6 #4	695.26	58.1%	#4	58.1%		le silt, (SP-SM)			1
					#10	943.70	40.4%	#10	40.4%	1	, (0)	<u> </u>	····	
PART F: HYDROMET	ER TEST C	ON FINE FRA	CHON		#10	943.70	40.470	#20	31.6%		USCS:	SP-SM		
					}		:	#40	27.4%		0000.	<u> </u>		
HYDROMETER TYPE		152H						#60	21.7%	}				
HYDROMETER NUMI	BER:	15-1515					***	#100	11.4%	ţ	LL:			
BEAKER NUMBER:		24			PARTG: S	SIEVE OF -	F 10	n	6.3%	1	PL:	<b></b>		
FLASK NUMBER:		5			ŀ		BEB 05155	#200		İ	PI:	<del></del>		
SPECIFIC GRAVITY:		2.71					PERCENT	0.0507	2.9%	l	r i:			•
PORTION TESTED:		-#10			1	WEIGHT	FINER	0.0295	2.0%					
MOIST WT. OF SOIL (g		69.15					1	0.0181	1.7%		D10:	0.13		
CORRECTED DRY W.	Γ(g):	66.71			TARE (g)	73.71		0.0115	1.7%			0.13		
Rm:		1			#20	88.37	78.0%	0.0067	1.1%		D30:	5.00		
					#40	95.14	67.9%	a	1.0%		D60:			
}		TEMP.	READ.		#60	104.59	53.7%	0.0023	0.4%		Cu:	38.5		
STANDARD SOLUTIO	N	19.4	8.0		#100	121.64	28.2%	0.0014	0.2%	1	Cz:	0.7		
ZERO CORRECTION		27.0	6.0		#200	130.03	15.6%	l						
				<u> </u>		0000	- CORD	<u> </u>	ccc	CONSTANT				
		ELAPSED			ZERO	CORR.	CORR.	% FINER	EFF.	(T&Gs)	DIAM.		106 9	%TOTAL
		TIME		HYDRO	CORR.		FACTOR	% FINER		(1&Os) K	(mm)			AMPLE
D HR M	<u> </u>	(min.)	(C)	READING	(CONT.)	<u>t</u> .	8		L,cm		(11111)		DAINI	211.11.00
	*													
27 9 27		0.0			~ 4	0.2	1.0	7.1%	14.163	0.01348	0.0507		-1.29	2.9%
27 9 28		1.0	21.6	12.0	7.4			7.1% 4.9%		0.01348	0.0307		-1.53	2.0%
27 9 30	0	3.0	21.6	10.5	7.4					0.01348	0.0233		-1.74	1.7%
27 9 35	0	8.0	21.6	10.0	7.4			4.1%		0.01348	0.0115		-1.94	1.7%
27 9 47	0	20.0	21.6	10.0	7.4			4.1%					-2.18	1.1%
27 10 27	0	60.0	21.9	9.0	7.3			2.8%		0.01348	0.0067		-2.42	1.1%
27 12 27	0	180.0	22.1	8.5	7.3			2.4%		0.01332	0.0038		-2.42 -2.63	0.4%
27 17 27		480.0	22.3	7.5	7.2			1.0%		0.01332	0.0023		-2.86	0.4%
28 9 27	7 0	1440.0	21.5	7.5	7.4	. 0.2	1.0	0.4%	14.901	0.01348	0.0014	•	-4.60	U.270
										<del></del>				
											OLDER ASSO	CIATES IN	_	
PROJECT:		NTO/RI/FS R	OADS/ II	)			4 00 00			_	EOTECHNIC			DATODV
PROJECT NUMBER:	913-1101.	.601			DATE:		1-29-92				EDMOND, W			WATOK I
TECHNICIAN:	MF/BA				REVIEV	VED BY:	DPO		····	KI	EUMUNU, W.	NOTING 10		

### PARTICLE SIZE DISTRIBUTION

### US STANDARD SIEVE OPENING SIZES



Coarse	Fine	С	Med	Fine	
GRA	VEL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
East Service				-		SM	Grayish brown (5 YR 3/2),
Road	1						c-f SAND, some silt,
							some f gravel, (SM).

PROJECT:

MONSANTO/ RI/ FS ROADS/ ID

PROJECT NO.: 913-1101.601

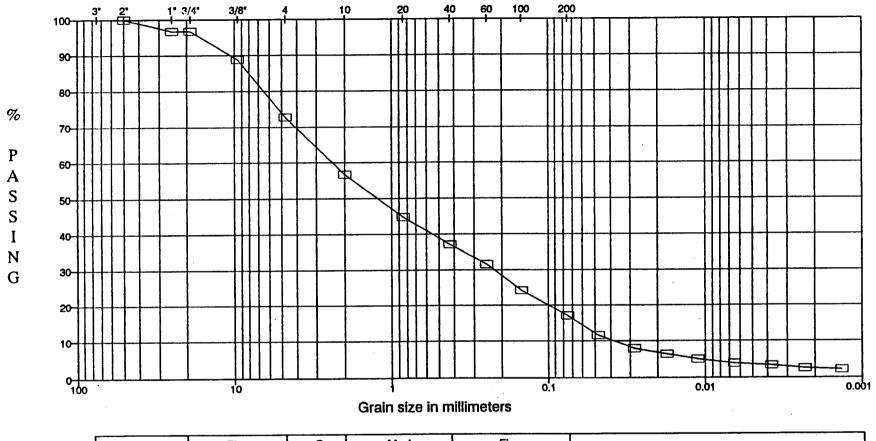
DATE: 1-29-92

TECH: MF/BA

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.

## PARTICLE SIZE ISTRIBUTION US STANDARD SIEVE OPENING SIZES



Coarse	Fine	С	Med	Fine	
GRA	VEL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
West Service		10.5				SM	Olive gray (5 Y 3/2),
Road						:	c-f SAND, some c-f gravel,
				,			some silt, (SM).

PROJECT:

MONSANTO/ RI/ FS ROADS/ ID

PROJECT NO.: 913-1101.601

DATE: 1-29-92

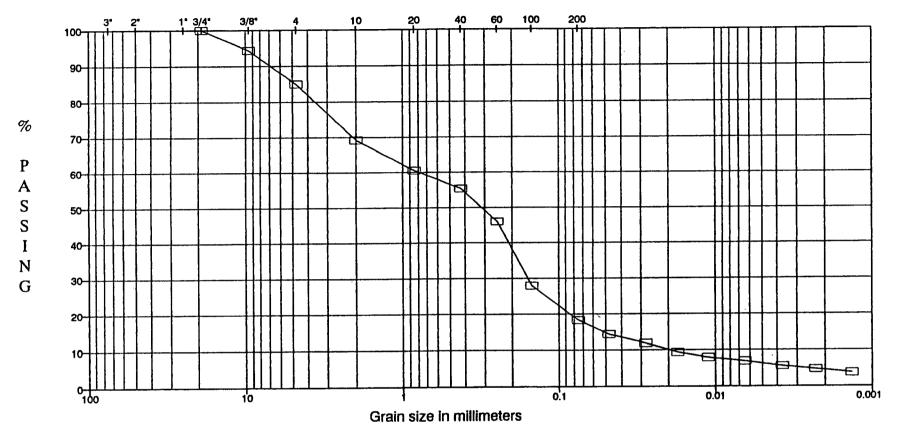
TECH: MF/BA

**RÉVIEW: DPO** 

GOLDER ASSOCIATES INC.

### PARTICLE SIZE DISTRIBUTION

#### US STANDARD SIEVE OPENING SIZES



Coarse	Fine	С	Med	Fine	
GRA	VEL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
Quartzite		11.4				SM	Dusky yellowish brown (10 YR 2/2),
Haul Road							c-f SAND, some silt,
							some f gravel, (SM).

PROJECT:

MONSANTO/ RI/ FS ROADS/ ID

PROJECT NO.: 913-1101.601

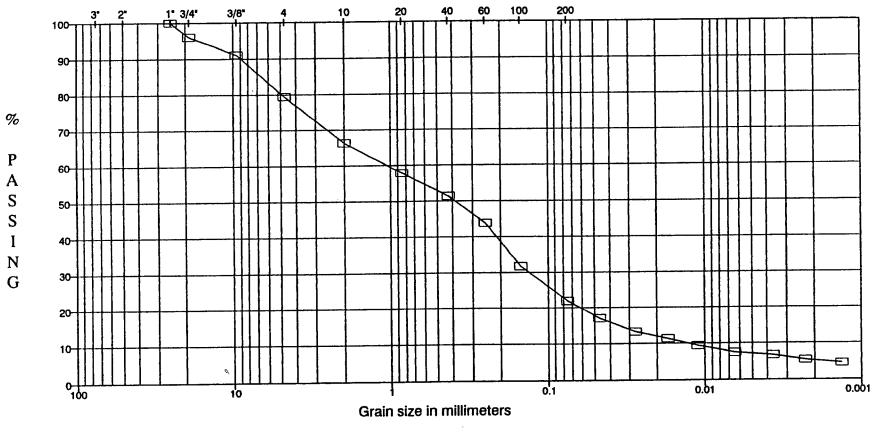
DATE: 1-29-92

TECH: MF/BA

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.

## PARTICLE SIZES ISTRIBUTION US STANDARD SIEVE OPENING SIZES



Coarse	Fine	С	Med	Fine	
GRA	/EL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
Ore Haul Road		12.0				SM	Dusky brown (5 YR 2/2),
							c-f SAND, some silt,
			ł				some c-f gravel, (SM).

PROJECT:

MONSANTO/ RI/ FS ROADS/ ID

PROJECT NO.: 913-1101.601

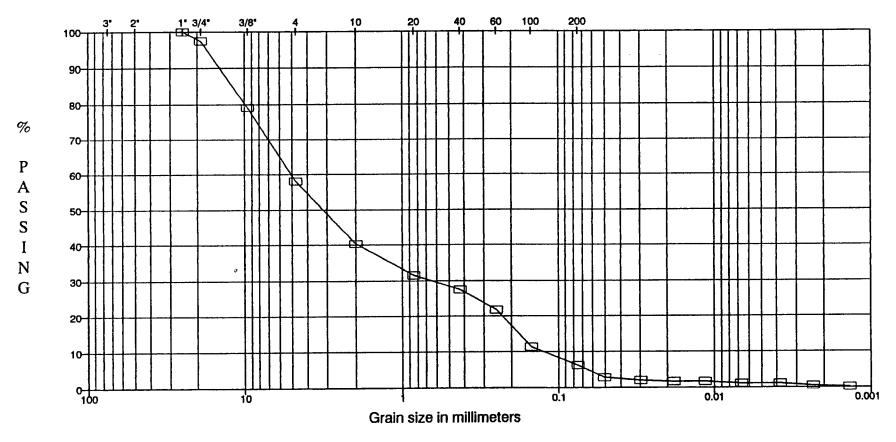
DATE: 1-29-92

TECH: MF/BA

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.

### PARTICLE SIZE DISTRIBUTION US STANDARD SIEVE OPENING SIZES



Coarse	Fine	С	Med	Fine	
GRA	VEL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
Slag Haul Road						SP-SM	Medium dark gray (N4),
							c-f SAND and f GRAVEL,
							little silt, (SP-SM).

PROJECT:

MONSANTO/ RI/ FS ROADS/ ID

PROJECT NO.: 913-1101.601

DATE: 1-29-92

TECH: MF/BA

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.

SAMPLE WEST Service Goad

Pycnometer number	L0208	
Temperature at weighings ( ^O C)	70.1	
Weight flask + soil + water (Wb)	702.29	
Weight flask + water (Wa)	658.74	
(Wa - W _b )	-43.56	
Evaporating dish number	12	
Weight dish + dry soil	68.32	
Weight dish	D D	
Weight dry soll (Wo)	68.32	
Temperature factor (K)	.0998	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

Comments:

Figure
SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 913-1101 CO1 Date 1-24-93 Tosted By MF Approved By DV



SAMPLE Quantail - Va. 1 Food

Pycnometer number	LO 213	
Temperature at weighings ( ^O C)	70.1	
Weight flask + soil + water (W _b )	697.75	
Weight flask + water (Wa)	656,57	
(Wa - Wb)	-41,18	
Evaporating dish number	K	
Weight dish + dry soil	6653	
Weight dish	0	
Weight dry soil (Wo)	6655	
Temperature factor (K)	,9998	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \bullet K = 3.62$$

Comments:

Figure
SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 913-1101 501 Date 1-24-93 Tested By

Approve

(2) Golder Associates

SAMPLE Dre Up 1

Pycnometer number	10213	
Temperature at weighings ( ^O C)	70.1	
Weight flask + soil + water (W _b )	698.47	
Weight flask + water (Wa)	25651	
(W _a - W _b )	41.96	
Evaporating dish number	6A	
Weight dish + dry soil	66.56	•
Weight dish	D D	
Weight dry soil (Wo)	. 66,56	A
Temperature factor (K)	9999	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_2 - W_0)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} \cdot W_{b})} \cdot K = 2.7$$

Comments:

Figure
SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 915-1101 CO1 Date 1-24-93 Tested By MF Approved By DO Golder Associates

	,		
SAMPLE	Slaa	Haul	الهو عن الأ

Pycnometer number	LO 208 .	
Temperature at weighings ( ^O C)	70.1	
Weight flask + soil + water (Wb)	702.68	
Weight flask + water (Wa)	658.74	
(Wa - Wb)	-43.94	
Evaporating dish number	12	
Weight dish + dry soil	69.67	
Weight dish	0	
Weight dry soil (Wo)	69.67	
Temperature factor (K)	, a a a 8	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_{0}}{W_{0} + (W_{a} \cdot W_{b})} \cdot K = 2.7$$

Comments:

## Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project MONTON +0 /RI/F5 Roads /ID
Project No. 915-1101. (0) Date 1-24-93 Tested By MF Approved By DID @ Golder Associates

# APPENDIX C SOURCE CHEMICAL PROPERTIES

# APPENDIX C-1 PHASE I RESULTS

TABLE C-1

Page 1 of 3

SAMPLE NUMBER (if any) SLAG-1		SAMPLE LOCATION SLAG PILE	ALUMINUM 7429-90-5 (mg/L)	QUAL	(mg/L)	QUAL	BERYLLIUM 7440–41–7 (mg/L)		CADMIUM 7440-43-9 (mg/L)	QUAL	CHROMIUM 7440-47-3 (mg/L)	QUAL	COPPER 7440-50-8 (mg/L)	QUA
SLAG-2	1	SLAG PILE	15900	'	13	J	4.5		48.2		302	J	67.4	┢
SLAG-3	1	SLAG PILE	19200 17200	'	3.3	J	5		35		544	J	68	
DUST-1		BAGHOUSE DUST	5350		4.7	J	4.7		17.5		237	J	22	
DUST-2		BAGHOUSE DUST	14500	,	13 34	J	1	U	3.8		27	J	8	
DUST-3		BAGHOUSE DUST	17500	ارا	34 85	,	4.2		125		390	J	40.5	1
UNDERFLOW-1	10/28/91	UNDERFLOW SOLIDS	23700	j	245	,	4.7		504		509	J	52	1
UNDERFLOW-2		UNDERFLOW SOLIDS	26500	j	245	,	6		1150		979	J	84.4	
UNDERFLOW-3	10/28/91	UNDERFLOW SOLIDS	2780	,	210		5.5 5.7	l [	1060		969	J	81.9	
SLURRY-1	10/28/91	SLURRY PONDS	15030		500		3.7 3.7	<u> </u>	1730		1110	J	82	
SLURRY-2	10/28/91	SLURRY PONDS	7240	J	11	ا ز	3.7		215		529	J	56.9	1
SLURRY-3	10/28/91	SLURRY PONDS	27700	J	185	ا ز	5.2	1 1	19 620		137 964	J	86.9 76.9	

TABLE C-1 (Cont'd.)

Page 2 of 3

SAMPLE NUMBER (if any)	DATE SAMPLED	(mg/L)	QUAL	(mg/L)	QUAL	MANGANESE 7439-96-5 (mg/L)	QUAL	NICKEL 7440-02-0 (mg/L)	QUAL	POTASSIUM 7440-09-7 (mg/L)	QUAL	SELENIUM 7782-49-2 (mg/L)	QUAL	SILVER 7440-22-4 (mg/L)	QUAL
SLAG-1	10/28/91	4400	J	26		140		65		5650	J	0.6	IJ	16	<del>                                     </del>
SLAG-2	10/28/91	4670	J	12		115	1	89.9	1	6690	J	1.2	J	7.5	İ
SLAG-3	10/28/91	2040	J	5.6		130	i I	32	1 1	6790	J	1.7	J	9	İ
DUST-1	10/28/91	4280	J	4.4		42	1	15	1 1	799	ارا	0.6	j	1	ŀ
DUST-2	10/28/91	8740	J	38		105		69.9		5390		0.8	UJ		
DUST-3	10/28/91	10000	J	104		165	1 1	110	1 1	7490	1	0.6	UJ	17	1
UNDERFLOW-1	10/28/91	10600	J	200	ļ	210		170		13200	انا	0.6	UJ	13	1
UNDERFLOW-2	10/28/91	11700	J	170	1	222	1 }	170		13200	ازا	0.8	UJ	15	1
UNDERFLOW-3	10/28/91	10400	J	135		105	l 1	112		13600	انا	0.6	UJ	13	1
SLURRY-1	10/28/91	10300	J	75		80	1	90		6090		0.6	UJ	16	1
SLURRY-2	10/28/91	7540	J	28		67	1 1	50		1900	"	0.6	N)		ļ
SLURRY-3	10/28/91	12200	J	110		75		155		9890	J	0.6	N1	3 29	

#### TABLE C-1 (Cont'd.)

Page 3 of 3

#### CHEMICAL ANALYTICAL RESULTS FOR INORGANIC COMPOUNDS IN SOURCE SAMPLES, MONSANTO PHASE I RIFS

	[									CATION				
SAMPLE	DATE	SODIUM		VANADIUM	1 1	ZINC	, ,			EXCHANGE		NITRATE/		i
NUMBER	SAMPLED	7440-23-5	QUAL	7440-62-2	QUAL	7440 <del>-68-6</del>	QUAL	FLUORIDE	QUAL	CAPACITY	QUAL	NITRITE	QUAL	рН
(if any)	<u> </u>	(mg/L)		(mg/L)		(mg/L)		(mg/kg)		(mg/kg)		(mg/kg)	1	(std units)
SLAG-1	10/28/91	4050		492		839	7	54.4		5.7		1.4		9.7
SLAG-2	10/28/91	3390	ļ ,	574		307	J	46.3		3.2	]	1.0	lυ	9.9
SLAG-3	10/28/91	3220		262		5.1	J	168		5.9		1.0	lυ	9.8
DUST-1	10/28/91	150		37	i i	62	J	46.3	1	3.2		21	l	7.9
DUST-2	10/28/91	2410		549	<b>j</b> !	1790	J	122		8.2	}	3.4	1	8.6
DUST-3	10/28/91	2760		769		4450	J	240	l	7.8	1	3.7		8.0
UNDERFLOW-1	10/28/91	4660		1500		9990	J	349		12.3		16.0	1	6.4
UNDERFLOW-2	10/28/91	4950		1600		10900	J	36.4		13.8		10.0		6.5
UNDERFLOW-3	10/28/91	4260		1810	1	8190	J	297	ŀ	18		79		6.0
SLURRY-1	10/28/91	2120	l	649		3160	j	336	ţ	6.4	ļ	2.9		7.7
SLURRY-2	10/28/91	729	(	275		385	J	104		4.7	(	1.0	lu	7.8
SLURRY-3	10/28/91	2970	l	1540		7940	J	205		16.0	ł	6.2	_	7.4

J ESTIMATED VALUE

U NOT DETECTED, VALUE REPORTED IS THE SQL

UJ NOT DETECTED, DETECTION LIMIT ESTIMATED DUE TO DEFICIENCY IN QC

TABLE C-2

Page 1 of 2

SAMPLE	SAMPLE	SAMPLE	LEAD-210			POLONIUM	-210		POTASSIUN	<b>/</b> −40		RADIU	M-226		RADIU	M-228	
NUMBER	DATE	LOCATION	@46 KeV	Error	Qual	TOTAL	Error	Qual	@1460KeV	Error	Qual		Error	Qual	<del>                                     </del>	Error	Qual
(if any)	mm/dd/yy		pCi/g	(+/-)		pCi/g	(+/-)	1	pCi/g	(+/-)	İ	pCi/a	(+/-)		pCi/g	(+/-)	
			(dry)	1		(dry)	1	]	(dry)		ŀ	(dry)	ľ ,		(dry)	,	j
SLAG-1	10/28/91	SLAG PILE	6.6	0.6		7.0	0.6	1	6.6	1.4		43	1		0.0	0.3	<del>                                     </del>
SLAG-2	10/28/91	SLAG PILE	1.2	0.3	ŀ	0.3	0.4	U	6.7	1.4	1	54	2		0.0	0.3	i
SLAG-3	10/28/91	SLAG PILE	6.6	0.6	1	5.8	0.6	1	6.8	1.4		46	2		0.7	0.3	
DUST-1	10/28/91	BAGHOUSE DUST	1.6	0.3	1	1.0	0.4	1	1.6	0.5	i	1.2	0.2	ļ	0.2	0.2	1
DUST-2	10/28/91	BAGHOUSE DUST	40	1 1	1	48	2	1	7.2	1.2	1	32	1		0.0	0.3	1
DUST-3	10/28/91	BAGHOUSE DUST	100	10	1	94	2	Ī	6.2	1.0	Ī	26	;		0.4	0.2	
UNDERFLOW-1	10/28/91	UNDERFLOW SOLIDS	250	10	1	260	10	1	9.4	1.5		36			0.6	0.4	
UNDERFLOW-2	10/28/91	UNDERFLOW SOLIDS	260	10		99	5	1	11	1	ł	35	1 ;	1	1.0	0.4	1
UNDERFLOW-3	10/28/91	UNDERFLOW SOLIDS	240	10	1	120	10	1	9.5	1.5	j	42	1 :	ļ	0.4	0.4	I
SLURRY-1	10/28/91	SLURRY PONDS	37	1		23	"	l	3.4	0.8	Ì	10	1 :	}	0.3	0.3	1
SLURRY-2	10/28/91	SLURRY PONDS	29	1 1		24	1 ;	1	4.9	0.9	i	12	1 :	Į		1	
SLURRY-3	10/28/91	SLURRY PONDS	120	10		100	10	ł	9.8	1.2		17		1	0.0	0.2	

#### TABLE C-2 (Cont'd.)

### CHEMICAL ANALYTICAL RESULTS FOR RADIOLOGICAL PARAMETERS IN SOURCE SAMPLES, MONSANTO PHASE I RI/FS Page 2 of 2

SAMPLE	SAMPLE	THORIU	M-228		THORIU	M-230		THORIUM	-232		URANIU	M	
NUMBER	DATE	TOTAL	Error	Quat	TOTAL	Error	Qual	TOTAL	Error	Qual	TOTAL	Error	Qual
(if any)	mm/dd/yy	pCi/g	(+/-)	1	pCi/g	(+/-)	ł	pCl/g	(+/-)		pCi/a	(+/-)	1
	<u> </u>	(dry)			(dry)	j		(dry)			(dry)	ľ. <i>'</i>	į .
SLAG-1	10/28/91	0.6	0.3		46	2		4.8	0.8		41	5	<del>                                     </del>
SLAG-2	10/28/91	0.3	0.3	1	40	3		0.1	0.1		47	4	
SLAG-3	10/28/91	5.1	2.9	1	430	20		3.1	2.1		44	5	
DUST-1	10/28/91	0.1	0.2	U	1.0	0.3	U	0.1	0.1		1.3	0.5	l
DUST-2	10/28/91	0.4	0.2	ļ	33	2		0.4	0.2		35	4	
DUST-3	10/28/91	0.3	0.2	ļ	24	2		0.5	0.3		24	3	l
UNDERFLOW-1	10/28/91	0.4	0.2	1	39	2		0.6	0.2		31	4	1
UNDERFLOW-2	10/28/91	0.5	0.3		38	2		0.2	0.2		34	4	4
UNDERFLOW-3	10/28/91	0.4	0.2	1	44	2		0.2	0.1		41	5	
SLURRY-1	10/28/91	0.2	0.2	U	9.1	0.7		0.3	0.1	1	10	,	ļ
SLURRY-2	10/28/91	0.3	0.2	1	12	1		0.4	0.2		9.5	1.7	
SLURRY-3	10/28/91	0.6	0.3		19	1		1.6	0.4	1	15	1.6	

U NOT DETECTED, VALUE REPORTED IS THE SQL

# APPENDIX C-2 PHASE II RESULTS







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SAMPLE	DATE	ANALYSIS	ALUMINUM		ARSENIC		BERYLLIUM		CADMIUM	1	CATION
LOCATION	SAMPLED		7429-90-5	QUAL	744-38-2	QUAL	7440-41-7	QUAL	7440-43-9	QUAL	EXCHANGE
			(mg/kg)	,	(mg/kg)		(mg/kg)		(mg/kg)	GOAL	CAPACITY (meq/100 g)
BAGDUST-1	10/28/91	SUB200	5350	J	13	J	1	U	3.8	<del>                                     </del>	3.2
BAGDUST-2	10/28/91	SUB200	14500	J	34	J	4.2		125		8.2
BAGDUST-3	10/28/91	SUB200	17500	J	85	J	4.7		504	l i	7.6
COKE PILE #1	12/13/92	TOTAL	7450		6.7	J	0.92	ا ں ا	6.6	ا با	7.0
COKE PILE #1	12/13/92	SUB200	645	i i	1.4	R	0.45	U	0.25	U	
COKE PILE #1R	10/29/93	TOTAL									
COKE PILE #1R	10/29/93	SUB200								] ]	
COKE PILE #2	12/13/92	TOTAL	4160	i !	0.29	บม	1	U	5.8	U	
COKE PILE #2	12/13/92	SUB200	790		2.9	J	0.25	ŭ	1.8	Ü	
COKE PILE #2R	10/29/93	TOTAL							1.0		
COKE PILE #2R	10/29/93	SUB200									
COKE PILE #3	12/13/92	TOTAL	1000		0.81	J	1.2	U	9.6	ا ں ا	
COKE PILE #3	12/13/92	SUB200	615		2	Ĵ	0.2	ן ט	3.8	U	
COKE PILE #3R	10/29/93	TOTAL			_		<b></b>		3.6		
COKE PILE #3R	10/29/93	SUB200						i 1			
COKE/QUARTZ SLURRY #1	10/29/93	TOTAL				1		i i		1 1	
COKE/QUARTZ SLURRY #1	10/29/93	SUB200		ı		i				1 1	
COKE/QUARTZ SLURRY #2	10/29/93	TOTAL								1	
COKE/QUARTZ SLURRY #2	10/29/93	SUB200									
COKE/QUARTZ SLURRY #3	10/29/93	TOTAL									
COKE/QUARTZ SLURRY #3	10/29/93	SUB200		1							
FERROPHOS SLAG #1	12/16/92	TOTAL	4660	İ	1.4	J	60.1		22.0		
FERROPHOS SLAG #1	10/29/93	TOTAL		1			<del>50.</del> 1		33.2		
FERROPHOS SLAG #1	10/29/93	SUB200	ĺ	İ		ļ					
FERROPHOS SLAG #2	12/16/92	TOTAL	5250	i	1.1	J	53		41.3		
FERROPHOS SLAG #2	10/29/93	TOTAL		ł	[				41.3		
FERROPHOS SLAG #2	10/29/93	SUB200	i	ļ	[						·
FERROPHOS SLAG #3	12/16/92	TOTAL	5730		1.2	J	56.7	- 1	22 5		
FERROPHOS SLAG #3	10/29/93	TOTAL	1	1		"	30.7	j	33.5		
FERROPHOS SLAG #3	10/29/93	SUB200	j	l	j			ĺ			
NEW NODULES #1	12/14/92	TOTAL	16100	J	5	,	13.7			1	
NEW NODULES #1	10/29/93	TOTAL		-	Ĭ	,	13./	ł	14.6	U	
NEW NODULES #1	10/29/93	SUB200	Ī	ļ	ł	i	j	[		1	

SAMPLE	DATE	ANALYSIS	ALUMINUM	ANIC PA		IN SOU		ES, M		HASE	T
LOCATION	SAMPLED	ANALISIS	7429-90-5	QUAL	ARSENIC	<b> </b>	BERYLLIUM		CADMIUM	i	CATION
1				UUAL	744-38-2	QUAL	l .	QUAL	f	QUAL	EXCHANGE
NEW NODULES #2	12/14/92	TOTAL	(mg/kg) . 12200	<b>—</b> —	(mg/kg)		(mg/kg)	ļ	(mg/kg)	ļ	CAPACITY (meq/100 g)
NEW NODULES #2	10/29/93	TOTAL	. 12200	J	1.9	เกา	13.6		11.8	U	
NEW NODULES #2	10/29/93	SUB200				ŧ					
NEW NODULES #3	12/14/92	TOTAL	15700	J	1.0	_				1	
NEW NODULES #3	10/29/93	TOTAL	13700		1.9	R	13.1		18.8		
NEW NODULES #3	10/29/93	SUB200			"						
NEW SLAG #1	12/14/92	TOTAL	17200	J	0.5	w	10.0				
NEW SLAG #1	10/29/93	TOTAL	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		0.5	03	12.6		28.5		
NEW SLAG #1	10/29/93	SUB200									
NEW SLAG #2	12/14/92	TOTAL	15800	J	0.5		4.0				
NEW SLAG #2	10/29/93	SUB200	.0000	ľ	0.9	พ	13		17.9		
NEW SLAG #2	10/29/93	TOTAL								l	
NEW SLAG #3	12/14/92	TOTAL	15900	,	0.5	ພ	12.7		4-3		
NEW SLAG #3	10/29/93	SUB200		·	0.5	03	12.7		17.5		
NEW SLAG #3	10/29/93	TOTAL		į						}	
<b>NEW TREATER DUST #1</b>	12/13/92	TOTAL	9650	1	2.5	į	6.4		37.5	ł	
<b>NEW TREATER DUST #1</b>	10/29/93	TOTAL		f			0.4		37.5	l	
NEW TREATER DUST #1	10/29/93	SUB200		- 1	,						
NEW TREATER DUST #2	12/13/92	TOTAL	7260	1	5	J	1.8	ן ט	31.2		
NEW TREATER DUST #2	10/29/93	TOTAL	Ĭ	ļ	_		1.0	١	31.2		
NEW TREATER DUST #2	10/29/93	SUB200		ŀ				1		I	
NEW TREATER DUST #3	12/13/92	TOTAL	9090		2.5	J	6.7		52.2	ı	
NEW TREATER DUST #3	10/29/93	TOTAL	i	1		Ĭ,	•		52.2	- 1	
NEW TREATER DUST #3	10/29/93	SUB200	İ	ļ		j	ļ		j		
OLD NODULES #1	12/14/92	SUB200	5150	- 1	11.4	J	4	u	7.7	U	
OLD NODULES #1	10/29/93	TOTAL		1	j	-	·	Ĭ	′.′	١	
OLD NODULES #1	10/29/93	SUB200			j	1	J	1	ľ		
OLD NODULES #2	12/14/92	SUB200	5710	- 1	1	R	3.8	u	7.3	U	
OLD NODULES #2	10/29/93	TOTAL		İ		1		_	, . <b>.</b>	١	
OLD NODULES #2	10/29/93	SUB200	]	ŀ	j		į		1	ł	
OLD NODULES #3	12/14/92	SUB200	5910	ł	1.4	R	3.7	u	2.3	u	
OLD NODULES #3	10/29/93	SUB200		1	j	l l		_		١	





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SAMPLE	DATE	ANALYSIS	ALUMINUM		ARSENIC		BERYLLIUM		CADMIUM	17.02	CATION
LOCATION	SAMPLED		7429-90-5	QUAL	744-38-2	QUAL	7440-41-7	QUAL	7440-43-9	QUAL	EXCHANGE
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	COME	CAPACITY (meq/100 g)
OLD NODULES #3	10/29/93	TOTAL									on non made too ge
OLD SLAG #1	12/14/92	TOTAL	1650		2.6	υ	6.7		17.6		
OLD SLAG #1	10/29/93	SUB200						<b>!</b>			
OLD SLAG #1	10/29/93	TOTAL									
OLD SLAG #2	12/14/92	TOTAL	20100	J	2.5		9.2		12.7	υ	
OLD SLAG #2	10/29/93	TOTAL									
OLD SLAG #2	10/29/93	SUB200									
OLD SLAG #3	12/14/92	TOTAL	14300	J	2.5	υ	7.7		20.2		
OLD SLAG #3	10/29/93	TOTAL							14.1		
OLD SLAG #3	10/29/93	SUB200									
ORE BLEND 1A	12/7/92	TOTAL	6820	J	1	υ	3.5	J	112	J	
ORE BLEND 1A	12/7/92	SUB200	6060	J	25.9	j	1.2	j	127	J	
ORE BLEND 1A	10/29/93	TOTAL							127	ŭ	
ORE BLEND 1A	10/29/93	SUB200							i		
ORE BLEND 1B	12/7/92	TOTAL	10600	J	1.1	U	3.3	J	109	J	
ORE BLEND 1B	12/7/92	SUB200	9600	J	21.3	j	1.9	J	116	ا ر	
ORE BLEND 1B	10/29/93	TOTAL									
ORE BLEND 1B	10/29/93	SUB200									
ORE BLEND 1C	12/7/92	TOTAL	7390	J	1.1	υ	3.5	J	138	J	
ORE BLEND 1C	12/7/92	SUB200	8260	J	26	J	1.6	J	119	ار	
ORE BLEND 1C	10/29/93	SUB200		ĺ		j			,,,,	_	
ORE BLEND 1C	10/29/93	TOTAL				- 1				ļ	
ORE BLEND 2A	12/5/92	TOTAL	14800	J	1.1	υİ	4.3	ا ز	149	J	
ORE BLEND 2A	12/5/92	SUB200	8900	J	36.9	J	1.3	j	132	ار	
ORE BLEND 2A	10/29/93	SUB200			Ī					·	
ORE BLEND 2A	10/29/93	TOTAL		. 1	j	į				ı	
ORE BLEND 2B	12/5/92	TOTAL	19500	J	1.1	U	4.7	J	135	ا ر	
ORE BLEND 2B	12/5/92	SUB200	9140	J	25	J	1.4	J	135	j	
ORE BLEND 2B	10/29/93	TOTAL	ļ	1	1	ĺ		ĺ			
ORE BLEND 28	10/29/93	SUB200	i	ŀ		Į	ľ	- 1		]	1
ORE BLEND 2C	12/5/92	TOTAL	21500	J	1.1	U	4.5	J	112	J	1
ORE BLEND 2C	12/5/92	SUB200	8760	J	23.8	J	1.2	J	129	ĭ	
ORE BLEND 2C	10/29/93	TOTAL					ļ	1	1	•	1

			S FOR INORGA	AIVIC PA		11N 300		ES, M	UNSANTO P	HASE	I RI/FS
SAMPLE	DATE	ANALYSIS	ALUMINUM		ARSENIC		BERYLLIUM		CADMIUM		CATION
LOCATION	SAMPLED	ł	7429-90-5	QUAL	744-38-2	QUAL	7440-41-7	QUAL	7440-43-9	QUAL	EXCHANGE
	<b></b> -		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		CAPACITY (meq/100 g)
ORE BLEND 2C	10/29/93	SUB200									
QUARTZITE #1	12/5/92	TOTAL	1200	J	1.5	J	0.1	U	0.3	J	
QUARTZITE #1	12/5/92	TOTAL	1260	J	2	J	0.1	υ	0.35	J	
QUARTZITE #1	10/29/93	TOTAL									
QUARTZITE #1	10/29/93	SUB200									
QUARTZITE #2	12/5/92	TOTAL	1170	J	0.88	J	0.1	u	0.25	J	
QUARTZITE #2	12/5/92	TOTAL	1480	J	1.8	J	0.1	U	0.3	J	
QUARTZITE #2	10/29/93	TOTAL				İ		1 1			
QUARTZITE #2	10/29/93	SUB200	•								
QUARTZITE #3	12/5/92	TOTAL	1020	J	0.8	J	0.15	ı	0.25	UJ	
QUARTZITE #3	12/5/92	TOTAL	1100	ا ر	1.1	,	0.1	υ	0.25	J	
QUARTZITE #3	10/29/93	SUB200							0.20		
QUARTZITE #3	10/29/93	TOTAL		i i						i i	
SLAG-1	10/28/91	SUB200	15900	ا ر	13	J	4.5		48.2		5.7
SLAG-2	10/28/91	SUB200	19200	ן נ	3.3	ا ر ا	5	İ	35		3.2
SLAG-3	10/28/91	SUB200	17200	J	4.7	J	4.7		17.5		5.9
SLURRY-1	10/28/91	SUB200	15030	J	500	j	3.7		215		6.4
SLURRY-2	10/28/91	SUB200	7240	J	11	J	3		19		4.7
SLURRY-3	10/28/91	SUB200	27700	J	185	j	5.2		620		16
TREATER DUST #1	12/14/92	SUB200	8300	ا ر	5.6	Ĵ	3.2	U	129		10
OLD TREATER DUST #1	10/29/93	TOTAL					<b>5.2</b>		123		
OLD TREATER DUST #1	10/29/93	SUB200		ŀ							
TREATER DUST #2	12/14/92	SUB200	9100	J	2	ارا	3	U	134		
OLD TREATER DUST #2	10/29/93	SUB200			-	Ĭ	ŭ	١	137		
OLD TREATER DUST #2	10/29/93	TOTAL		l						ļ	
OLD TREATER DUST #2D	10/29/93	SUB200		ſ							
OLD TREATER DUST #2D	10/29/93	TOTAL									
TREATER DUST #3	12/14/92	SUB200	8150		2	J	2.9	υ	120	İ	
OLD TREATER DUST #3	10/29/93	TOTAL			~	, j	2.9	١	130		
OLD TREATER DUST #3	10/29/93	SUB200						Ì			
UNDERFLOW SOLIDS 1-1	10/28/91	SUB200	23700	J	245	J	6	-	1150		10.0
UNDERFLOW SOLIDS 1-2	10/28/91	SUB200	26500	ار	245	i i	ı	- 1		l	12.3
						J	5.5		1060		13.8







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### CHEMICAL ANALYTICAL RESULTS FOR INORGANIC PARAMETERS IN SOURCE SAMPLES, MONSANTO PHASE II RI/FS

SAMPLE	DATE	ANALYSIS	ALUMINUM		ARSENIC			LO, W	UNSANTU P	HASE	I RI/FS
LOCATION	SAMPLED		7429-90-5	QUAL	_		BERYLLIUM		CADMIUM		CATION
			(mg/kg)	GOAL	744-38-2	QUAL	7440-41-7	QUAL	7440-43-9	QUAL	EXCHANGE
UNDERFLOW SOLIDS 1-3	10/28/91	SUB200	27800	<del></del>	(mg/kg)		(mg/kg)		(mg/kg)		CAPACITY (meq/100
UNDERFLOW SOLIDS 2-1	12/13/92	TOTAL		, ,	210	J	5.7	i	1730		16
UNDERFLOW SOLIDS 2-2	12/14/92	TOTAL	26600	, ,	125		15.4		2070	ا ر	
UNDERFLOW SOLIDS 2-3	12/13/92	TOTAL	25300		70.1		15.4		662	ار	
NEW UFS #1	10/29/93	SUB200	23100	,	84.5		13.1		859	ارا	
NEW UFS #1	10/29/93	TOTAL				Ī				ł	
NEW UFS #2	10/29/93	TOTAL		1	1	1		ļ			
NEW UFS #2	10/29/93	SUB200	Í	ł		Í		1		- 1	
NEW UFS #3	10/29/93	TOTAL		1		1					
NEW UFS #3	10/29/93	SUB200	ì			I					

ş

SAMPLE	DATE	ANALYSIS	CHROMIUM		COPPER	1 3001	FLUORIDE	IRON	I PHAS	T	
LOCATION	SAMPLED			QUAL		QUAL	TEOCHIDE	7439-89-6	QUAL	LEAD 7439-92-1	
	1		(mg/kg)		(mg/kg)		(mg/kg)	(mg/kg)	UOAL		QUAL
BAGDUST-1	10/28/91	SUB200	27	J	8		46.3	4280	J	(mg/kg) 4.4	<del> </del>
BAGDUST-2	10/28/91	SUB200	390	J	40.5		122	8740	Ĵ	38	ŀ
BAGDUST-3	10/28/91	SUB200	509	J	52		240	10000	Ĵ	104	
COKE PILE #1	12/13/92	TOTAL	30.6				115	10000		104	
COKE PILE #1	12/13/92	SUB200	2.2				1.02				
COKE PILE #1R	10/29/93	TOTAL					1				
COKE PILE #1R	10/29/93	SUB200							•		
COKE PILE #2	12/13/92	TOTAL	8.1				10.5				
COKE PILE #2	12/13/92	SUB200	37.9				9.64		•	[	
COKE PILE #2R	10/29/93	TOTAL									
COKE PILE #2R	10/29/93	SUB200									
COKE PILE #3	12/13/92	TOTAL	33.7	i			90.8			1	
COKE PILE #3	12/13/92	SUB200	47.3		i		5.8				
COKE PILE #3R	10/29/93	TOTAL				ļ				l	
COKE PILE #3R	10/29/93	SUB200		i							
COKE/QUARTZ SLURRY #1	10/29/93	TOTAL				1					
COKE/QUARTZ SLURRY #1	10/29/93	SUB200				ļ				l	
COKE/QUARTZ SLURRY #2	10/29/93	TOTAL								1 1	
COKE/QUARTZ SLURRY #2	10/29/93	SUB200				i		•		1	
COKE/QUARTZ SLURRY #3	10/29/93	TOTAL	I	i		ŀ				ŀ	
COKE/QUARTZ SLURRY #3	10/29/93	SUB200		1		1				i i	
FERROPHOS SLAG #1	12/16/92	TOTAL	30500			ļ	9.02	I		[ ]	
FERROPHOS SLAG #1	10/29/93	TOTAL				ŀ	0.02				
FERROPHOS SLAG #1	10/29/93	SUB200	İ	i		- 1					
FERROPHOS SLAG #2	12/16/92	TOTAL	26300	ŀ			9.41				
FERROPHOS SLAG #2	10/29/93	TOTAL	·	- 1		ľ	2.47				
FERROPHOS SLAG #2	10/29/93	SUB200			ľ						
FERROPHOS SLAG #3	12/16/92	TOTAL	29700		ļ F		9.69				
FERROPHOS SLAG #3	10/29/93	TOTAL			i		3.03				
FERROPHOS SLAG #3	10/29/93	SUB200		1	f			]			
NEW NODULES #1	12/14/92	TOTAL	450	-			15.7				
NEW NODULES #1	10/29/93	TOTAL			į	i	19.7				
NEW NODULES #1	10/29/93	SUB200					{	i		}	







SAMPLE	DATE	ANALYSIS	CHROMIUM		COPPER	1	FILLOPIDE		TOTHAS	<del></del>	T
LOCATION	SAMPLED	'	7440-47-3	QUAL		QUAL	FLUORIDE	IRON		LEAD	
			(mg/kg)	COAL	(mg/kg)	GUAL		7439-89-6	QUAL	7439-92-1	QUAL
NEW NODULES #2	12/14/92	TOTAL	455		(mg/kg)	<del>                                     </del>	(mg/kg) 13.4	(mg/kg)		(mg/kg)	<b> </b> -
NEW NODULES #2	10/29/93	TOTAL	"50				13.4				
NEW NODULES #2	10/29/93	SUB200		j l							
NEW NODULES #3	12/14/92	TOTAL	736			1	9.52	<b>!</b>			
NEW NODULES #3	10/29/93	TOTAL					3.32	]			
NEW NODULES #3	10/29/93	SUB200									
NEW SLAG #1	12/14/92	TOTAL	230				71.1				
NEW SLAG #1	10/29/93	TOTAL					71.1				
NEW SLAG #1	10/29/93	SUB200									
NEW SLAG #2	12/14/92	TOTAL	337				50,8				
NEW SLAG #2	10/29/93	SUB200	,				30.8				
NEW SLAG #2	10/29/93	TOTAL									
NEW SLAG #3	12/14/92	TOTAL	120	İ			30.8				
NEW SLAG #3	10/29/93	SUB200					33.3				
NEW SLAG #3	10/29/93	TOTAL								1	
NEW TREATER DUST #1	12/13/92	TOTAL	454				14500			į i	
NEW TREATER DUST #1	10/29/93	TOTAL									
<b>NEW TREATER DUST #1</b>	10/29/93	SUB200									
NEW TREATER DUST #2	12/13/92	TOTAL	382				2130				
NEW TREATER DUST #2	10/29/93	TOTAL	i				· · ·				
NEW TREATER DUST #2	.10/29/93	SUB200				ŀ					
NEW TREATER DUST #3	12/13/92	TOTAL	466	- 1			8790				
NEW TREATER DUST #3	10/29/93	TOTAL		Ī							
NEW TREATER DUST #3	10/29/93	SUB200				l					
OLD NODULES #1	12/14/92	SUB200	592	ı		1	29.4				
OLD NODULES #1	10/29/93	TOTAL	1			ł					•
OLD NODULES #1	10/29/93	SUB200			1						
OLD NODULES #2	12/14/92	SUB200	475	1		1	38	ĺ			
OLD NODULES #2	10/29/93	TOTAL	1	ł	1	j					
OLD NODULES #2	10/29/93	SUB200		ļ	İ	1		- 1		ľ	
OLD NODULES #3	12/14/92	SUB200	571	j	I	1	22	ļ		l	
OLD NODULES #3	10/29/93	SUB200	I								

SAMPLE	DATE	ANALYSIS	CHROMIUM		COPPER		FLUORIDE	IRON		LEAD	
LOCATION	SAMPLED		7440-47-3	QUAL	7440-50-8	QUAL		7439-89-6	QUAL	7439-92-1	QUAL
			(mg/kg)		(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)	
OLD NODULES #3	10/29/93	TOTAL									
OLD SLAG #1	12/14/92	TOTAL	222				52.3				
OLD SLAG #1	10/29/93	SUB200						1			
OLD SLAG #1	10/29/93	TOTAL		l						]	ļ
OLD SLAG #2	12/14/92	TOTAL	213				30.9				
OLD SLAG #2	10/29/93	TOTAL									
OLD SLAG #2	10/29/93	SUB200							,		
OLD SLAG #3	12/14/92	TOTAL	129			Î	68.4				
OLD SLAG #3	10/29/93	TOTAL									
OLD SLAG #3	10/29/93	SUB200						1			
ORE BLEND 1A	12/7/92	TOTAL	771	J			57.7				
ORE BLEND 1A	12/7/92	SUB200	707	J			15.9				
ORE BLEND 1A	10/29/93	TOTAL									
ORE BLEND 1A	10/29/93	SUB200									
ORE BLEND 1B	12/7/92	TOTAL	860	J			51.9				
ORE BLEND 1B	12/7/92	SUB200	1090	J			39.3				
ORE BLEND 1B	10/29/93	TOTAL				1					
ORE BLEND 1B	10/29/93	SUB200	:								
ORE BLEND 1C	12/7/92	TOTAL	824	J			68.5				
ORE BLEND 1C	12/7/92	SUB200	962	J			74.9				
ORE BLEND 1C	10/29/93	SUB200									
ORE BLEND 1C	10/29/93	TOTAL									
ORE BLEND 2A	12/5/92	TOTAL	993	J		ŀ	36.6				
ORE BLEND 2A	12/5/92	SUB200	709	J		İ	6.1	•			
ORE BLEND 2A	10/29/93	SUB200				J					
ORE BLEND 2A	10/29/93	TOTAL		l	İ	:					
ORE BLEND 2B	12/5/92	TOTAL	1040	J			3.96				•
ORE BLEND 2B	12/5/92	SUB200	949	J		İ	5.4				
ORE BLEND 2B	10/29/93	TOTAL					- ·				
ORE BLEND 2B	10/29/93	SUB200						1			
ORE BLEND 2C	12/5/92	TOTAL	1260	J		ļ	33				
ORE BLEND 2C	12/5/92	SUB200	826	J		1	8.3				
ORE BLEND 2C	10/29/93	TOTAL				ł	•.•	Ì		,	





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SAMPLE	DATE	ANALYSIS	CHROMIUM		COPPER	1 3001	FLUORIDE	IRON	FIAS	LEAD	<u> </u>
LOCATION	SAMPLED		7440-47-3	QUAL	7440-50-8	QUAL	, 20011102	7439-89-6	QUAL	7439-92-1	QUAL
			(mg/kg)		(mg/kg)	TOAL	(mg/kg)	/435-85-6 (mg/kg)	QUAL		UUAL
ORE BLEND 2C	10/29/93	SUB200	,g,g,		(1118178)		(my/ky/	(mg/kg)		(mg/L)	
QUARTZITE #1	12/5/92	TOTAL	2.5	] , ]		j ,					
QUARTZITE #1	12/5/92	TOTAL	2.9	ارا							
QUARTZITE #1	10/29/93	TOTAL					:				
QUARTZITE #1	10/29/93	SUB200									
QUARTZITE #2	12/5/92	TOTAL	2	ا ر ا							
QUARTZITE #2	12/5/92	TOTAL	2.7	J				i			
QUARTZITE #2	10/29/93	TOTAL									
QUARTZITE #2	10/29/93	SUB200									
QUARTZITE #3	12/5/92	TOTAL	0.86	J				i		1	
QUARTZITE #3	12/5/92	TOTAL	1.7	J							
QUARTZITE #3	10/29/93	SUB200									
QUARTZITE #3	10/29/93	TOTAL									
SLAG-1	10/28/91	SUB200	302	J	67.4		54.4	4400	J	26	
SLAG-2	10/28/91	SUB200	544	J	68		46.3	4670	J	12	
SLAG-3	10/28/91	SUB200	237	J	22		168	2040	J	5.6	
SLURRY-1	10/28/91	SUB200	529	J	56.9		336	10300	J	75	
SLURRY-2	10/28/91	SUB200	137	J	86.9		104	7540	j	28	
SLURRY-3	10/28/91	SUB200	964	J	76.9		205	12200	j	110	
TREATER DUST #1	12/14/92	SUB200	274	l			300				
OLD TREATER DUST #1	10/29/93	TOTAL	٠						ı		
OLD TREATER DUST #1	10/29/93	SUB200									
TREATER DUST #2	12/14/92	SUB200	296			Ī	300				
OLD TREATER DUST #2	10/29/93	SUB200		1							
OLD TREATER DUST #2	10/29/93	TOTAL				1					
OLD TREATER DUST #2D	10/29/93	SUB200		l							
OLD TREATER DUST #2D	10/29/93	TOTAL		İ		1		į			
TREATER DUST #3	12/14/92	SUB200	279	ļ			264	ŀ			
OLD TREATER DUST #3	10/29/93	TOTAL		İ	•						
OLD TREATER DUST #3	10/29/93	SUB200									
UNDERFLOW SOLIDS 1-1	10/28/91	SUB200	979	J	84.4		349	10600	J	200	
UNDERFLOW SOLIDS 1-2	10/28/91	SUB200	969	J	91.9	_	36.4	11700	J	170	

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CHEMICAL ANALYTICAL DECLILECTOR INCORCANIO DADAMATERO DA DAMATERO DA DAMATERO DA DAMATERO DA DAMATERO DA DAMATERO DA DAMATERO DA DAMATERO DA DAMATERO DA DAMATERO DA DAMATERO DA DAMATERO DA DA DAMATERO DA DA DA DA DA DA DA DA DA DA DA DA DA	μu
CHEMICAL ANALYTICAL RESULTS FOR INORGANIC PARAMETERS IN SOURCE SAMPLES, MONSANTO P	11405 11 51 55
TO THE WILLIAM TO THE WILLIAM TO SAMIFLES, WONSANTO P	HASE II RIJES

SAMPLE	DATE	ANALYSIS	CHROMIUM		COPPER		FLUORIDE		1011173	T	<del></del>
LOCATION	SAMPLED		7440-47-3	QUAL		QUAL	reconing	IRON 7439-89-6	QUAL	LEAD 7439-92-1	QUA
	ļi		(mg/kg)		(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)	ا
UNDERFLOW SOLIDS 1-3	10/28/91	SUB200	1110	J	82		297	10400		135	
UNDERFLOW SOLIDS 2-1	12/13/92	TOTAL	1120				656	10400	,	135	
UNDERFLOW SOLIDS 2-2	12/14/92	TOTAL	1090				509				
UNDERFLOW SOLIDS 2-3	12/13/92	TOTAL	1090				705				
NEW UFS #1	10/29/93	SUB200					705				
NEW UFS #1	10/29/93	TOTAL									
NEW UFS #2	10/29/93	TOTAL									
NEW UFS #2	10/29/93	SUB200		ļ		i					
NEW UFS #3	10/29/93	TOTAL									
NEW UFS #3	10/29/93	SUB200									







CANADIE				TIMIN		NUE SAMPLES	S, MUNSAI	VIU PHA	SE II HI/FS	
SAMPLE	DATE	ANALYSIS	MANGANESE		MOLYBDENUM	ł	NICKEL		NITRATE/	
LOCATION	SAMPLED		7439-96-5	QUAL		QUAL	7440-02-0	QUAL	NITRITE	QUAL
BAGDUST-1	10/65/55	0115.5.5	(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
1	10/28/91	SUB200	42		:		15		21	
BAGDUST-2	10/28/91	SUB200	105	1			69.9		3.4	
BAGDUST-3	10/28/91	SUB200	165	1 1			110		3.7	
COKE PILE #1	12/13/92	TOTAL	4.8		0.87	U				
COKE PILE #1	12/13/92	SUB200	11	]	0.85	U				
COKE PILE #1R	10/29/93	TOTAL		1 1						
COKE PILE #1R	10/29/93	SUB200						•	]	
COKE PILE #2	12/13/92	TOTAL	3.1		1.1	υ			i I	
COKE PILE #2	12/13/92	SUB200	15.2		3.2					
COKE PILE #2R	10/29/93	TOTAL		i i						
COKE PILE #2R	10/29/93	SUB200		1 1						
COKE PILE #3	12/13/92	TOTAL	4.7		1.2					
COKE PILE #3	12/13/92	SUB200	16.9	1 1	2.4			l.		
COKÉ PILE #3R	10/29/93	TOTAL		1 1					ĺ	
COKE PILE #3R	10/29/93	SUB200		[ ]					! !	
COKE/QUARTZ SLURRY #1	10/29/93	TOTAL								
COKE/QUARTZ SLURRY #1	10/29/93	SUB200		i i					}	
COKE/QUARTZ SLURRY #2	10/29/93	TOTAL								
COKE/QUARTZ SLURRY #2	10/29/93	SUB200		1 1						`
COKE/QUARTZ SLURRY #3	10/29/93	TOTAL	·	ł	j					
COKE/QUARTZ SLURRY #3	10/29/93	SUB200		1	Ī					
FERROPHOS SLAG #1	12/16/92	TOTAL	899		878					
FERROPHOS SLAG #1	10/29/93	TOTAL							1	
FERROPHOS SLAG #1	10/29/93	SUB200			1					
FERROPHOS SLAG #2	12/16/92	TOTAL	807		809				ľ	ĺ
FERROPHOS SLAG #2	10/29/93	TOTAL								4
FERROPHOS SLAG #2	10/29/93	SUB200			i					,
FERROPHOS SLAG #3	12/18/92	TOTAL	833	ļ	893				ľ	
FERROPHOS SLAG #3	10/29/93	TOTAL		1	333		ľ		j	- 1
FERROPHOS SLAG #3	10/29/93	SUB200	·		İ	İ	i		<b> </b>	j
NEW NODULES #1	12/14/92	TOTAL	39		15.5			ĺ		İ
NEW NODULES #1	10/29/93	TOTAL			15.5	1				ļ
NEW NODULES #1	10/29/93	SUB200		ŀ	ļ	Ì			ľ	
		20200								j

SAMPLE	DATE	ANALYSIS	MANGANESE		MOLYBDENUM		NICKEL		NITRATE/	]
LOCATION	SAMPLED		7439-96-5	QUAL		QUAL	7440-02-0	QUAL	NITRITE	QUAL
			(mg/kg)	<u></u>	(mg/kg)		(mg/kg)		(mg/kg)	
NEW NODULES #2	12/14/92	TOTAL	27.7		9.7					
NEW NODULES #2	10/29/93	TOTAL								
NEW NODULES #2	10/29/93	SUB200							l ·	
NEW NODULES #3	12/14/92	TOTAL	47		16.3					
NEW NODULES #3	10/29/93	TOTAL		]						
NEW NODULES #3	10/29/93	SUB200								
NEW SLAG #1	12/14/92	TOTAL	47.3	l l	2.3		}		1	
NEW SLAG #1	10/29/93	TOTAL		i l						
NEW SLAG #1	10/29/93	SUB200								
NEW SLAG #2	12/14/92	TOTAL	46.5	1 1	4.3		1		1	
NEW SLAG #2	10/29/93	SUB200		1 1						
NEW SLAG #2	10/29/93	TOTAL								
NEW SLAG #3	12/14/92	TOTAL	43.1	<b>!</b> [	0.85	U	l		1	
NEW SLAG #3	10/29/93	SUB200			*	J	1		] [	
NEW SLAG #3	10/29/93	TOTAL								
NEW TREATER DUST #1	12/13/92	TOTAL	66.8	] ,	6.7		[			
NEW TREATER DUST #1	10/29/93	TOTAL			0.,,					
NEW TREATER DUST #1	10/29/93	SUB200		i i			l ł			
NEW TREATER DUST #2	12/13/92	TOTAL	53.6		7.7				]	
NEW TREATER DUST #2	10/29/93	TOTAL								
NEW TREATER DUST #2	10/29/93	SUB200		l i			l l		l	
NEW TREATER DUST #3	12/13/92	TOTAL	50.7		6.3		Ī			
NEW TREATER DUST #3	10/29/93	TOTAL		[ ]	0.0			į		
NEW TREATER DUST #3	10/29/93	SUB200			j					
OLD NODULES #1	12/14/92	SUB200	48.1		40.6					
OLD NODULES #1	10/29/93	TOTAL		İ	40.0					
OLD NODULES #1	10/29/93	SUB200								•
OLD NODULES #2	12/14/92	SUB200	81.8		30.4	ļ				
OLD NODULES #2	10/29/93	TOTAL	·			j				
OLD NODULES #2	10/29/93	SUB200							l	
OLD NODULES #3	12/14/92	SUB200	65.2	[	23.3					
OLD NODULES #3	10/29/93	SUB200		Ì			j		İ	







SAMPLE	DATE	ANALYSIS	MANGANESE	T	MOLYBDENUM	TOL SAMI LEC	NICKEL	VIO FRA		· · · · · ·
LOCATION	SAMPLED		7439-96-5	QUAL		QUAL	7440-02-0	QUAL	NITRATE/	01141
	<u> </u>		(mg/kg)		(mg/kg)	GOAL		QUAL	NITRITE	QUAL
OLD NODULES	#3 10/29/93	TOTAL			(mg/kg/		(mg/kg)		(mg/kg)	
OLD SLAG #	1 12/14/92	TOTAL	111	J	1.3		i			İ
OLD SLAG #	1 10/29/93	SUB200			.,,					
OLD SLAG #	1 10/29/93	TOTAL	İ	i :						
OLD SLAG #	2 12/14/92	TOTAL	153	l J	1.4					
OLD SLAG #	2 10/29/93	TOTAL								
OLD SLAG #	2 10/29/93	SUB200		i i				i		]
OLD SLAG #	3   12/14/92	TOTAL	74.4	J	0.85	υ				
OLD SLAG #:	3 10/29/93	TOTAL		1 1	510.2					
OLD SLAG #:	3 10/29/93	SUB200								
ORE BLEND 1	A 12/7/92	TOTAL	41.8	J	26.8					
ORE BLEND 1.	A 12/7/92	SUB200	72.7	<u>.</u>	40.8					
ORE BLEND 1	A 10/29/93	TOTAL			,5,0					
ORE BLEND 1.	A 10/29/93	SUB200		l i						
ORE BLEND 1	B 12/7/92	TOTAL	42.4	,	20.6					-
ORE BLEND 1	B 12/7/92	SUB200	65.7	J	32.1					
ORE BLEND 1	B 10/29/93	TOTAL			<b></b> .					
ORE BLEND 1	B 10/29/93	SUB200								
ORE BLEND 1	C 12/7/92	TOTAL	34.9	J	9.5		1			
ORE BLEND 10	12/7/92	SUB200	89.1	J	20					1
ORE BLEND 10	10/29/93	SUB200								ļ
ORE BLEND 10	10/29/93	TOTAL								1
ORE BLEND 2/	12/5/92	TOTAL	33.6	J	8.8					İ
ORE BLEND 2/	12/5/92	SUB200	68.4	J	27.7	j	ŀ	İ		]
ORE BLEND 2/	10/29/93	SUB200	ĺ	1		i			1	İ
ORE BLEND 24	10/29/93	TOTAL		- 1					İ	
ORE BLEND 28		TOTAL	28.5	J	15.6				Ī	
ORE BLEND 28	1	SUB200	43.3	J	30.4	j		j		Į
ORE BLEND 28	10/29/93	TOTAL		[						
ORE BLEND 28		SUB200								
ORE BLEND 20		TOTAL	43.9	J	12.4	1	1	- 1		
ORE BLEND 20		SUB200	69.9	J	30.6	•			1	
ORE BLEND 20	10/29/93	TOTAL					ł		1	1

SAMPLE	DATE	ANALYSIS	MANGANESE	AHAM	ETERS IN SOL	JRCE SAMPLE	S, MONSA	NTO PHA	SE II RI/FS	age 14
LOCATION	SAMPLE		7439-96-5	Į	MOTARDENOW		NICKEL		NITRATE/	
			(mg/kg)	QUAL	l	QUAL	7440-02-0	QUAL	NITRITE	QUAL
ORE BLEND 2C	10/29/93	SUB200	, ing/kg/	<del> </del>	(mg/kg)		(mg/kg)		(mg/kg)	1
QUARTZITE #1	12/5/92		4.9	U						
QUARTZITE #1	12/5/92	1	9.6		0.86	U	1 1			
QUARTZITE #1	10/29/93		3.0	"	0.86	U	1 1			Ì
QUARTZITE #1	10/29/93			1 1		İ	1 1			•
QUARTZITE #2	12/5/92	TOTAL	5.9	1 [			1 1			ł
QUARTZITE #2	12/5/92	TOTAL	3.8	U	0.86	U	1 1		}	
QUARTZITE #2	10/29/93	TOTAL	0.0	١١١	0.85	U	1 1			
QUARTZITE #2	10/29/93	SUB200								
QUARTZITE #3	12/5/92	TOTAL	5.1	U			j i			
QUARTZITE #3	12/5/92	TOTAL	2.3	U	0.86	U				
QUARTZITE #3	10/29/93	SUB200	2.0	"	0.86	U				
QUARTZITE #3	10/29/93	TOTAL								
SLAG-1	10/28/91	SUB200	140							
SLAG-2	10/28/91	SUB200	115	- 1			65		1.4	
SLAG-3	10/28/91	SUB200	130	Į			89.9		1	U
SLURRY-1	10/28/91	SUB200	80	i	į		32		1	U
SLURRY-2	10/28/91	SUB200	67		1	l	90	- [	2.9	
SLURRY-3	10/28/91	SUB200	75	- 1		İ	50	l	1	U ·
TREATER DUST #1	12/14/92	SUB200	241	Ţ			155	I	6.2	
OLD TREATER DUST #1	10/29/93	TOTAL		ł	4	ł	j	ł	ŀ	
OLD TREATER DUST #1	10/29/93	SUB200			ļ	İ	}	Ī		
TREATER DUST #2	12/14/92	SUB200	206	1	1.1					
OLD TREATER DUST #2	10/29/93	SUB200			'.'	1	1	- 1		j
OLD TREATER DUST #2	10/29/93	TOTAL	İ	- 1	1		1	1		
OLD TREATER DUST #2D	10/29/93	SUB200	l			ļ		ł	i	- 1
OLD TREATER DUST #2D	10/29/93	TOTAL	[			]	l			
TREATER DUST #3	12/14/92	SUB200	243	1	3	ŀ		1		1
OLD TREATER DUST #3	10/29/93	TOTAL		İ	•			1		ł
OLD TREATER DUST #3	10/29/93	SUB200	1		j	1		1		1
UNDERFLOW SOLIDS 1-1	10/28/91	SUB200	210	1	}	1		1	1	j
UNDERFLOW SOLIDS 1-2	10/28/91	SUB200	222			İ	170		18	ĺ
							170		10	







SAMPLE	DATE	ANALYSIS	MANGANESE		MOLYBDENUM		NICKEL		NITRATE/	
LOCATION	SAMPLED		7439-96-5	QUAL		QUAL	7440-02-0	QUAL	NITRITE	QUAL
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
UNDERFLOW SOLIDS 1-3	10/28/91	SUB200	105				112		79	
UNDERFLOW SOLIDS 2-1	12/13/92	TOTAL	93.3	J	41.4					
UNDERFLOW SOLIDS 2-2	12/14/92	TOTAL	96.4	J	31.2					
UNDERFLOW SOLIDS 2-3	12/13/92	TOTAL	88.6	J	34.9					
NEW UFS #1	10/29/93	SUB200								
NEW UFS #1	10/29/93	TOTAL								
NEW UFS #2	10/29/93	TOTAL								
NEW UFS #2	10/29/93	SUB200	i							
NEW UFS #3	10/29/93	TOTAL								
NEW UFS #3	10/29/93	SUB200								

SAMPLE	DATE	ANALYSIS	POTASSIUM	J I AIIAI	SELENIUM	ONCE SAMIFE	SILVER	I U PHAS	SODIUM	
LOCATION	SAMPLED		7440-09-7	QUAL	7782-49-2	QUAL	7440-22-4	QUAL	7440-23-5	QUAL
			(mg/kg)		(mg/kg)	20/12	(mg/kg)	don't	1	UUAL
BAGDUST-1	10/28/91	SUB200	799	J	0.6	J	1	<del> </del>	(mg/kg) 150	
BAGDUST-2	10/28/91	SUB200	5390	J	0.6	UJ	9		2410	
BAGDUST-3	10/28/91	SUB200	7490	J	0.6	υJ	17		2760	
COKE PILE #1	12/13/92	TOTAL					0.98		2,00	
COKE PILE #1	12/13/92	SUB200			.2	U	0.25	J		
COKE PILE #1R	10/29/93	TOTAL			2.2	_	0,20			
COKE PILE #1R	10/29/93	SUB200						İ		
COKE PILE #2	12/13/92	TOTAL					0.06	U		
COKE PILE #2	12/13/92	SUB200					0.36	J	}	
COKE PILE #2R	10/29/93	TOTAL			.604	В	0.50	,		
COKE PILE #2R	10/29/93	SUB200			.88	J			1	
COKE PILE #3	12/13/92	TOTAL			.474	В	1.4		<u> </u>	
COKE PILE #3	12/13/92	SUB200			.72	J	0.22	J		
COKE PILE #3R	10/29/93	TOTAL				J	0.22	,		
COKE PILE #3R	10/29/93	SUB200								
COKE/QUARTZ SLURRY #1	10/29/93	TOTAL			18.5	L	,			
COKE/QUARTZ SLURRY #1	10/29/93	SUB200			24.1	j	i			
COKE/QUARTZ SLURRY #2	10/29/93	TOTAL			13.1					
COKE/QUARTZ SLURRY #2	10/29/93	SUB200		j	8.9	J				
COKE/QUARTZ SLURRY #3	10/29/93	TOTAL			8.1	_			}	
COKE/QUARTZ SLURRY #3	10/29/93	SUB200		1	8.6	ا				
FERROPHOS SLAG #1	12/16/92	TOTAL				J	43.1	J		
FERROPHOS SLAG #1	10/29/93	TOTAL	I		1	ພ	45.1	,		
FERROPHOS SLAG #1	10/29/93	SUB200			3.1					
FERROPHOS SLAG #2	12/16/92	TOTAL	ļ				19.6	J		
FERROPHOS SLAG #2	10/29/93	TOTAL	j	i	.387	BJ	13.5	,		
FERROPHOS SLAG #2	10/29/93	SUB200	1	1	1.8					•
FERROPHOS SLAG #3	12/16/92	TOTAL	Ī	[			27.9	J	]	
FERROPHOS SLAG #3	10/29/93	TOTAL	J	1	.22	BJ	27.3	,	ľ	
FERROPHOS SLAG #3	10/29/93	SUB200	ı		2.1	~		i		
NEW NODULES #1	12/14/92	TOTAL	1		<del>-</del> ]	1	4			
NEW NODULES #1	10/29/93	TOTAL		- 1	2.1	BJ .	"			
NEW NODULES #1	10/29/93	SUB200	İ		8.8	~				







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SAMPLE	DATE	ANALYSIS	POTASSIUM	CFARAIV	SELENIUM	UNCE SAMPI		TO PHA		<del></del> -
LOCATION	SAMPLED	1	7440-09-7	QUAL	7782-49-2	OUA!	SILVER		SODIUM	
		İ	(mg/kg)	GUAL	1	QUAL	7440-22-4	QUAL	7440-23-5	QUAL
NEW NODULES #2	12/14/92	TOTAL	triging/		(mg/kg)		(mg/kg)	<del> </del>	(mg/kg)	
NEW NODULES #2	10/29/93	TOTAL				<b>.</b> .	6.1			
NEW NODULES #2	10/29/93	SUB200			2.2 9.5	BJ				
NEW NODULES #3	12/14/92	TOTAL			9.5				1	
<b>NEW NODULES #3</b>	10/29/93	TOTAL		,	1		5.5	İ		
NEW NODULES #3	10/29/93	SUB200			26.5	บา		1		
NEW SLAG #1	12/14/92	TOTAL			20.5			:		
NEW SLAG #1	10/29/93	TOTAL				_	2.1			
NEW SLAG #1	10/29/93	SUB200			5.5	J	1			
NEW SLAG #2	12/14/92	TOTAL			6.2		1	1		
NEW SLAG #2	10/29/93	SUB200			_		2.7	J		
NEW SLAG #2	10/29/93	TOTAL	İ		7.4				ļ i	
NEW SLAG #3	12/14/92	TOTAL			7.4	J	1			
NEW SLAG #3	10/29/93	SUB200					2.3	J	1 1	
NEW SLAG #3	10/29/93	TOTAL			6.8		ł	ľ	] [	
NEW TREATER DUST #1	12/13/92	TOTAL			8.9	J		j		
NEW TREATER DUST #1	10/29/93	TOTAL					57.5		] ]	
NEW TREATER DUST #1	10/29/93	SUB200			14.8	J			]	
NEW TREATER DUST #2	12/13/92	TOTAL	·	1	21				]	
NEW TREATER DUST #2	10/29/93	TOTAL		ſ	10.0		48			
NEW TREATER DUST #2	10/29/93	SUB200		1	10.3	J	1		1	
NEW TREATER DUST #3	12/13/92	TOTAL		i	23.4				1	
NEW TREATER DUST #3	10/29/93	TOTAL		i	12.5	•	93.8	J		
NEW TREATER DUST #3	10/29/93	SUB200			7.2	J		•		
OLD NODULES #1	12/14/92	SUB200		J	7.2					
OLD NODULES #1	10/29/93	TOTAL	1	J	1.725	BJ	4.8	J	j j	
OLD NODULES #1	10/29/93	SUB200	1		7.6	ы				
OLD NODULES #2	12/14/92	SUB200	ĺ	j	<i>"</i> ."		] ,	_		
OLD NODULES #2	10/29/93	TOTAL	1	i	2.112	D I	7.1	J		
OLD NODULES #2	10/29/93	SUB200	1	- 1	6.2	เม				
OLD NODULES #3	12/14/92	SUB200	ļ	j	0.2		,_			
OLD NODULES #3	10/29/93	SUB200	1	Ī	11.2		4.5	J		

SAMPLE	DATE	ANALYSIS	POTASSIUM		SELENIUM		SILVER		SODIUM	
LOCATION	SAMPLED		7440-09-7	QUAL	7782-49-2	QUAL	7440-22-4	QUAL	7440-23-5	QUAL
			(mg/kg)		(mg/kg)		(mg/kg)	j	(mg/kg)	
OLD NODULES #3	10/29/93	TOTAL			6.3	J				
OLD SLAG #1	12/14/92	TOTAL					1.8	J		
OLD SLAG #1	10/29/93	SUB200			15.7		ŀ			
OLD SLAG #1	10/29/93	TOTAL			7.7	J	}			
OLD SLAG #2	12/14/92	TOTAL					0.75	İ		
OLD SLAG #2	10/29/93	TOTAL			2.4	J	<u>,</u>	ŀ		
OLD SLAG #2	10/29/93	SUB200			6.5				<u> </u>	
OLD SLAG #3	12/14/92	TOTAL				!	1.1			
OLD SLAG #3	10/29/93	TOTAL	1		2	J				
OLD SLAG #3	10/29/93	SUB200			4.4					
ORE BLEND 1A	12/7/92	TOTAL					8.8	R		
ORE BLEND 1A	12/7/92	SUB200					2.3	J		
ORE BLEND 1A	10/29/93	TOTAL			36.299	J		,	1	
ORE BLEND 1A	10/29/93	SUB200			46.3	_				
ORE BLEND 1B	12/7/92	TOTAL					5.8	R		
ORE BLEND 1B	12/7/92	SUB200					2.3	J		
ORE BLEND 1B	10/29/93	TOTAL			17.653	J	]			
ORE BLEND 1B	10/29/93	SUB200			68.7					
ORE BLEND 1C	12/7/92	TOTAL					5.6	R		
ORE BLEND 1C	12/7/92	SUB200		Ï			1.8	R		
ORE BLEND 1C	10/29/93	SUB200			21.8					
ORE BLEND 1C	10/29/93	TOTAL	j		29.337		·			
ORE BLEND 2A	12/5/92	TOTAL					13.6	R		
ORE BLEND 2A	12/5/92	SUB200	1				4.8	R		
ORE BLEND 2A	10/29/93	SUB200		ì	48			.,		
ORE BLEND 2A	10/29/93	TOTAL		ļ	56.244					
ORE BLEND 2B	12/5/92	TOTAL		ļ			12.9	R		•
ORE BLEND 2B	12/5/92	SUB200	İ	ļ			5.5	J		
ORE BLEND 2B	10/29/93	TOTAL	}	į	31.854	J	""	,		
ORE BLEND 2B	10/29/93	SUB200	ļ	- 1	75.2	, i	]			
ORE BLEND 2C	12/5/92	TOTAL	ļ	j			14.4	,		
ORE BLEND 2C	12/5/92	SUB200			·		3.4	R		
ORE BLEND 2C	10/29/93	TOTAL	i		33.936		5.7	,	Į	







CHEWICAL ANAL						· · · · · · · · · · · · · · · · · · ·				
SAMPLE	DATE	ANALYSIS	POTASSIUM		SELENIUM		SILVER		SODIUM	
LOCATION	SAMPLED		7440-09-7	QUAL	7782-49-2	QUAL	7440-22-4	QUAL	7440-23-5	QUAL
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
ORE BLEND 2C	10/29/93	SUB200			72.8					
QUARTZITE #1	12/5/92	TOTAL					0.05	UR		
QUARTZITE #1	12/5/92	TOTAL					0.05	UR		·
QUARTZITE #1	10/29/93	TOTAL			.2	U				
QUARTZITE #1	10/29/93	SUB200			.2	υ		ļ		
QUARTZITE #2	12/5/92	TOTAL					0.05	UR		
QUARTZITE #2	12/5/92	TOTAL					0.05	UR		
QUARTZITE #2	10/29/93	TOTAL			.2	U		1		•
QUARTZITE #2	10/29/93	SUB200			.2	U		1		
QUARTZITE #3	12/5/92	TOTAL					0.05	UR		
QUARTZITE #3	12/5/92	TOTAL					0.05	UR		
QUARTZITE #3	10/29/93	SUB200			.2	U				
QUARTZITE #3	10/29/93	TOTAL			.2	UJ		i		
SLAG-1	10/28/91	SUB200	5650	J	0.6	UJ	16		4050	
SLAG-2	10/28/91	SUB200	6690	J	1.2	J	7.5		3390	
SLAG-3	10/28/91	SUB200	6790	J	1.7	J	9		3220	
SLURRY-1	10/28/91	SUB200	6090	j	0.6	LU	16	l	2120	
SLURRY-2	10/28/91	SUB200	1900	J	0.6	UJ	3		729	
SLURRY-3	10/28/91	SUB200	9890	J	0.6	UJ	29		2970	
TREATER DUST #1	12/14/92	SUB200					7.3	J		
OLD TREATER DUST #1	10/29/93	TOTAL			34.5	J				
OLD TREATER DUST #1	10/29/93	SUB200			60.4		j			
TREATER DUST #2	12/14/92	SUB200					4.2	J		
OLD TREATER DUST #2	10/29/93	SUB200			18.2					
OLD TREATER DUST #2	10/29/93	TOTAL			3.6	J				
OLD TREATER DUST #2D	10/29/93	SUB200			10.9					
OLD TREATER DUST #2D	10/29/93	TOTAL			5.5	Ð				
TREATER DUST #3	12/14/92	SUB200					7	J		
OLD TREATER DUST #3	10/29/93	TOTAL			38.8	J				
OLD TREATER DUST #3	10/29/93	SUB200			41.7					
UNDERFLOW SOLIDS 1-1	10/28/91	SUB200	13200	, J	0.6	ບນ	13		4660	
UNDERFLOW SOLIDS 1-2	10/28/91	SUB200	13200	J	0.6	ບນ	15		4950	

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UMENII AL ANALVIICAL DECLIITO FOD INODOANIO DADALATERDO MAGALETTE -	F - 4
CHEMICAL ANALYTICAL RESULTS FOR INORGANIC PARAMETERS IN SOURCE SAMPLES, MONS	ANTO DUADE U DUED
MUNS	ANTO PHASE II RIJES

SAMPLE	DATE	ANALYSIS	POTASSIUM		SELENIUM	51102 OF 11117 E	1	TOTIA	_	
LOCATION	1		1				SILVER	l	SODIUM	
LOCATION	SAMPLED		7440-09-7	QUAL	7782-49-2	QUAL	7440-22-4	QUAL	7440-23-5	QUAL
	ļ		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
UNDERFLOW SOLIDS 1-3	10/28/91	SUB200	13600		0.6	UJ	8			
UNDERFLOW SOLIDS 2-1	12/13/92	TOTAL				00	, i		4260	
UNDERFLOW SOLIDS 2-2	12/14/92	TOTAL					48.3			
UNDERFLOW SOLIDS 2-3	12/13/92	TOTAL					68.3			
NEW UFS #1	10/29/93	SUB200			196		54.7			
NEW UFS #1	10/29/93	TOTAL			199,105				]	
NEW UFS #2	10/29/93	TOTAL	j		·				]	
NEW UFS #2	10/29/93		1		132.403					
· · · · · · ·		SUB200			197					
NEW UFS #3	10/29/93	TOTAL	i		175.835				ŀ	
NEW UFS #3	10/29/93	SUB200			231				ľ	





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	SAMPLE	DATE	I AMALYSIS		ONCE 3	PAIVIFLES,	MUNSA	NIUP	1
	LOCATION	1	ANALYSIS		1	ZINC			
	200AHON	SAMPLED	1	7440-62-2	QUAL	7440-66-6	QUAL	pН	i
	BAGDUST-1	10/28/91	SUB200	(mg/L)	ļ	(mg/L)			
	BAGDUST-2	10/28/91	SUB200	37	1	62	J	7.9	7
	BAGDUST-3	10/28/91		549	1	1790	J	8.6	
	COKE PILE #1	12/13/92	SUB200	769	1	4450	٦	8	
	COKE PILE #1	12/13/92	TOTAL	58.7	1 i	265	J	1	Į
	COKE PILE #1R	10/29/93	SUB200	3.4	1 1	21.1		1	ı
	COKE PILE #1R	10/29/93	TOTAL	ì	1 1			I	İ
	COKE PILE #2	12/13/92	SUB200		1 1		j	ļ	١
	COKE PILE #2	12/13/92	TOTAL	11.3	1 1	4.3		]	l
ı	COKE PILE #2R	10/29/93	SUB200	18.8		48.2		l	l
	COKE PILE #2R	10/29/93	TOTAL		i i				I
	COKE PILE #3	12/13/92	SUB200		i i			İ	l
	COKE PILE #3	12/13/92	TOTAL	79.4	1 1	328	J	<b>[</b>	l
	COKE PILE #3R	10/29/93	SUB200	158		58.5		İ	
-	COKE PILE #3R	10/29/93	TOTAL			j			ı
1	COKE/QUARTZ SLURRY #1	10/29/93	SUB200						ĺ
1	COKE/QUARTZ SLURRY #1	10/29/93	TOTAL			1			l
١	COKE/QUARTZ SLURRY #2	10/29/93	SUB200		1				ļ
1	COKE/QUARTZ SLURRY #2	10/29/93	TOTAL			j			
1	COKE/QUARTZ SLURRY #3	10/29/93	SUB200		1	Ī			
ł	COKE/QUARTZ SLURRY #3	10/29/93	TOTAL		1			i	
1	FERROPHOS SLAG #1	12/16/92	SUB200 TOTAL		1		į	- 1	
l	FERROPHOS SLAG #1	10/29/93	TOTAL	60000	- 1	32.7		ŀ	
1	FERROPHOS SLAG #1	10/29/93	SUB200					- 1	
ł	FERROPHOS SLAG #2	12/16/92	TOTAL	FF100	1	1	1	ł	
	FERROPHOS SLAG #2	10/29/93	TOTAL	55100	j	60.5		- 1	
l	FERROPHOS SLAG #2	10/29/93	SUB200	İ	- 1		1	j	
l	FERROPHOS SLAG #3	12/16/92	TOTAL	85:00			- 1	- 1	
	FERROPHOS SLAG #3	10/29/93	TOTAL	65100		45.5	j		
	FERROPHOS SLAG #3	10/29/93	SUB200	j			1	-	
	NEW NODULES #1	12/14/92	TOTAL	1640	1		1	- 1	
	NEW NODULES #1	10/29/93	TOTAL	1040	- 1	13.4	Ì		
L	NEW NODULES #1	10/29/93	SUB200		- 1	j	- 1		
				<u></u>			!	- 1	

SAMPLE	DATE	ANALYSIS	VANADIUM	1	ZINC	INCINSAL	T T
LOCATION	SAMPLED	f	7440-62-2	QUAL	7440-66-6	QUAL	рH
			(mg/L)		(mg/L)	40AL	hu
NEW NODULES #2	12/14/92	TOTAL	1500	<del>                                     </del>	6		<del> </del>
NEW NODULES #2	10/29/93	TOTAL					ł
NEW NODULES #2	10/29/93	SUB200	1				
NEW NODULES #3	12/14/92	TOTAL	1550		12.4		1
NEW NODULES #3	10/29/93	TOTAL		<u> </u>			
NEW NODULES #3	10/29/93	SUB200					
NEW SLAG #1	12/14/92	TOTAL	484		4.5		
NEW SLAG #1	10/29/93	TOTAL					
NEW SLAG #1	10/29/93	SUB200					
NEW SLAG #2	12/14/92	TOTAL	835		0.75	U	1
NEW SLAG #2	10/29/93	SUB200					
NEW SLAG #2	10/29/93	TOTAL					
NEW SLAG #3	12/14/92	TOTAL	254		1.7	U	
NEW SLAG #3	10/29/93	SUB200					ļ
NEW SLAG #3	10/29/93	TOTAL		1			
NEW TREATER DUST #1	12/13/92	TOTAL	844		4180	j	
NEW TREATER DUST #1	10/29/93	TOTAL					
NEW TREATER DUST #1	10/29/93	SUB200					
NEW TREATER DUST #2	12/13/92	TOTAL	726	i	3910	J	
NEW TREATER DUST #2	10/29/93	TOTAL					
NEW TREATER DUST #2	10/29/93	SUB200	,	j			
NEW TREATER DUST #3	12/13/92	TOTAL	868	I	100	J	
NEW TREATER DUST #3	10/29/93	TOTAL			j		
NEW TREATER DUST #3	10/29/93	SUB200	ļ		i		
OLD NODULES #1	12/14/92	SUB200	1330		914	j	
OLD NODULES #1	10/29/93	TOTAL	ľ	İ		i	ı
OLD NODULES #1	10/29/93	SUB200					
OLD NODULES #2	12/14/92	SUB200	877	İ	690		
OLD NODULES #2	10/29/93	TOTAL	į			j	
OLD NODULES #2	10/29/93	SUB200	1	ł	[		
OLD NODULES #3	12/14/92	SUB200	1340	- 1	234	ı	1
OLD NODULES #3	10/29/93	SUB200					





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	THE THE TEST OF TO	THOMON	IVIC PANAI	ALE LEUS IN SOL	UNCES	SAMPLES,	<u>MUNS</u> A	<u>nto</u> pi	H/
	SAMPLE	DATE	ANALYSIS	VANADIUM		ZINC			٦
	LOCATION	SAMPLED	1	7440-62-2	QUAL	7440-66-6	QUAL	рН	1
				(mg/L)		(mg/L)	]	]	1
	OLD NODULES #3	10/29/93	TOTAL						1
	OLD SLAG #1	12/14/92	TOTAL	334		43.8			1
	OLD SLAG #1	10/29/93	SUB200				1	1	-
	OLD SLAG #1	10/29/93	TOTAL						1
I	OLD SLAG #2	12/14/92	TOTAL	287	1	15.2			1
j	OLD SLAG #2	10/29/93	TOTAL	}				1	
	OLD SLAG #2	10/29/93	SUB200					1	Ì
	OLD SLAG #3	12/14/92	TOTAL	186		17.1			
	OLD SLAG #3	10/29/93	TOTAL					İ	
1	OLD SLAG #3	10/29/93	SUB200					1	1
	ORE BLEND 1A	12/7/92	TOTAL	1270	ا ر	1980	J	1	
	ORE BLEND 1A	12/7/92	SUB200	1940	ر	3150	J	1	İ
1	ORE BLEND 1A	10/29/93	TOTAL				J	1	
	ORE BLEND 1A	10/29/93	SUB200						I
1	ORE BLEND 1B	12/7/92	TOTAL	1550	J	2400	J	1	
	ORE BLEND 1B	12/7/92	SUB200	2330	j	3320	J		
	ORE BLEND 1B	10/29/93	TOTAL			0020	,		
	ORE BLEND 1B	10/29/93	SUB200						l
	ORE BLEND 1C	12/7/92	TOTAL	1770	J	1650	j	ĺ	1
	ORE BLEND 1C	12/7/92	SUB200	2310	j	1940	J		
	ORE BLEND 1C	10/29/93	SUB200	-			J		
	ORE BLEND 1C	10/29/93	TOTAL			İ			l
	ORE BLEND 2A	12/5/92	TOTAL	1810	J	1230	J		
	ORE BLEND 2A	12/5/92	SUB200	1680	ار	1850	J		
	ORE BLEND 2A	10/29/93	SUB200	-	-		J		
ı	ORE BLEND 2A	10/29/93	TOTAL						l
	ORE BLEND 2B	12/5/92	TOTAL	1630	J	1290	J		
l	ORE BLEND 2B	12/5/92	SUB200	2200	١	1800	J		
	ORE BLEND 2B	10/29/93	TOTAL	1			•	·	l
	ORE BLEND 2B	10/29/93	SUB200			ł		,	l
	ORE BLEND 2C	12/5/92	TOTAL	1250	J	1290	J		
	ORE BLEND 2C	12/5/92	SUB200	1960	ار	1810	j		ì
L	ORE BLEND 2C	10/29/93	TOTAL		-		٠		
							Į.		

							—
SAMPLE	DATE	ANALYSIS	VANADIUM		ZINC		
LOCATION	SAMPLED		7440-62-2	QUAL	7440-66-6	QUAL	pН
			(mg/L)	Ì	(mg/L)		Ì
ORE BLEND 2C	10/29/93	SUB200				<del></del>	
QUARTZITE #1	12/5/92	TOTAL	0.66	J	2	U	
QUARTZITE #1	12/5/92	TOTAL	0.66	υ	6.1	U	l
QUARTZITE #1	10/29/93	TOTAL					•
QUARTZITE #1	10/29/93	SUB200					
QUARTZITE #2	12/5/92	TOTAL	0.66	U	3	U	
QUARTZITE #2	12/5/92	TOTAL	0.65	U	2.3	U	
QUARTZITE #2	10/29/93	TOTAL					
QUARTZITE #2	10/29/93	SUB200					
QUARTZITE #3	12/5/92	TOTAL	0.66	U	1.8	υ	
QUARTZITE #3	12/5/92	TOTAL	0.66	υ	0.76	Ü	
QUARTZITE #3	10/29/93	SUB200					
QUARTZITE #3	10/29/93	TOTAL					
SLAG-1	10/28/91	SUB200	492		839	J	9.7
SLAG-2	10/28/91	SUB200	574		307	j	9.9
SLAG-3	10/28/91	SUB200	262		5.1	j	9.8
SLURRY-1	10/28/91	SUB200	649	į	3160	j	7.7
SLURRY-2	10/28/91	SUB200	275		385	ا ر	7.8
SLURRY-3	10/28/91	SUB200	1540	l	7940	ا ر	7.4
TREATER DUST #1	12/14/92	SUB200	491	- 1	35600		
OLD TREATER DUST #1	10/29/93	TOTAL		l			
OLD TREATER DUST #1	10/29/93	SUB200					
TREATER DUST #2	12/14/92	SUB200	457	ľ	54200		
OLD TREATER DUST #2	10/29/93	SUB200		1	3 1.233	1	
OLD TREATER DUST #2	10/29/93	TOTAL			Į.		
OLD TREATER DUST #2D	10/29/93	SUB200	İ	1		Ĭ	
OLD TREATER DUST #2D	10/29/93	TOTAL		i	İ		
TREATER DUST #3	12/14/92	SUB200	488		36000	J	
OLD TREATER DUST #3	10/29/93	TOTAL		ļ	30000	ì	
OLD TREATER DUST #3	10/29/93	SUB200	ļ			.	
UNDERFLOW SOLIDS 1-1	10/28/91	SUB200	1500	j	9990	ا ر	6.4
UNDERFLOW SOLIDS 1-2	10/28/91	SUB200	1600		10900	ا ر	6.5







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SAMPLE	DATE	ANALYSIS	VANADIUM		ZINC		Ī
LOCATION	SAMPLED		7440-62-2	QUAL	7440-66-6	QUAL	рН
	<u> </u>		(mg/L)		(mg/L)		
UNDERFLOW SOLIDS 1-3	10/28/91	SUB200	1810		8190	J	6
UNDERFLOW SOLIDS 2-1	12/13/92	TOTAL	2050		11900	j	
UNDERFLOW SOLIDS 2-2	12/14/92	TOTAL	2040		6940	J	
UNDERFLOW SOLIDS 2-3	12/13/92	TOTAL	1970		7270	j	
NEW UFS #1	10/29/93	SUB200		l i		-	
NEW UFS #1	10/29/93	TOTAL					
NEW UFS #2	10/29/93	TOTAL					
NEW UFS #2	10/29/93	SUB200					
NEW UFS #3	10/29/93	TOTAL					
NEW UFS #3	10/29/93	SUB200					



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HEMICAL ANALYTICAL HES	ULIS FUR K	ADIOLOGICAL	LEAD-210	IS IN SOURCE	SAIV	POLONIUM-210	NIU PHAS	E 11 H1/F
LOCATION	DATE	ANALYSIS	@46KeV	ERROR	QUAL	TOTAL	ERROR	QUAL
LOCATION	DATE	ANALISIS		P	JUOAL			UUAL
			pCi/G	(+ <i>/</i> -)	1	pCi/G	(+/-)	
BAGDUST-1	10/28/91	SUB200	(dry) 1.6	0.3	<del>                                     </del>	(dry)	0.4	<del> </del>
BAGDUST-2	10/28/91	SUB200	40	1		48		
BAGDUST-3	10/28/91	SUB200	100	10	1 :	94	2 2	ļ
COKE PILE #1		TOTAL		'0	υ			U
COKE PILE #1	12/13/92	SUB200	0.46 3		"	0.1		"
	12/13/92		_	2.3	1	1	1.3	
COKE PILE #2	12/13/92	TOTAL	0.48		υ	0.5	0.7	
COKE PILE #2	12/13/92	SUB200	3.6	2.1	1 !	3.2	1.8	Į
COKE PILE #3	12/13/92	TOTAL	0.47		U	0.3	0.5	
COKE PILE #3	12/13/92	SUB200	4.3	3.6	1	5.9	5.1	
FERROPHOS SLAG #1	12/16/92	TOTAL	0.95		U	3	0.7	
FERROPHOS SLAG #2	12/16/92	TOTAL	1.3	0.9	U	4.6	2.2	
FERROPHOS SLAG #3	12/16/92	TOTAL	1	0.8	U	1.8	0.5	
NEW NODULES #1	12/14/92	TOTAL	0.2	2.6	U	1.6	0.9	
NEW NODULES #2	12/14/92	TOTAL	0.4	2.2	U	2.1	1.1	
NEW NODULES #3	12/14/92	TOTAL	1.3		U	0.6	0.6	
NEW SLAG #1	12/14/92	TOTAL	1.4	2.2	ן ט	0.6	0.5	1
NEW SLAG #2	12/14/92	TOTAL	1.7		ן ט ן	0.1	0.5	U
NEW SLAG #3	12/14/92	TOTAL	1.6		U	0.3		U
NEW TREATER DUST #1	12/13/92	TOTAL	120	10	1 1	76	8	
NEW TREATER DUST #2	12/13/92	TOTAL	94	10	1	78	7	1
NEW TREATER DUST #3	12/13/92	TOTAL	130	10	1	89	8	i
OLD NODULES #1	12/14/92	SUB200	4.6	3.8	U	3.7	1.8	
OLD NODULES #2	12/14/92	SUB200	5.7	3.8	U	9.1	2.5	
OLD NODULES #3	12/14/92	SUB200	5.4	2.8	U	2.3	1.3	
OLD SLAG #1	12/14/92	TOTAL	5.6	1.9		4.3	2	]
OLD SLAG #2	12/14/92	TOTAL	3.5	1.5	U	0.9	1.4	
OLD SLAG #3	12/14/92	TOTAL	11	2		17	3	
ORE BLEND 1A	12/7/92	TOTAL	40	3		50	8	
ORE BLEND 1A	12/7/92	SUB200	33	2		49	14	
ORE BLEND 1B	12/7/92	TOTAL	44	3		38	11	
ORE BLEND 1B	12/7/92	SUB200	33	3		30	8	
ORE BLEND 1C	12/7/92	TOTAL	40	2		29	9	
ORE BLEND 1C	12/7/92	SUB200	32	3		27	4	
ORE BLEND 2A	12/5/92	TOTAL	37	4		36	14	
ORE BLEND 2A	12/5/92	SUB200	28	2	1	29	12	<b>!</b>
ORE BLEND 2B	12/5/92	TOTAL	38	3		39	10	]
ORE BLEND 2B	12/5/92	SUB200	38	3		31	14	
ORE BLEND 2C	12/5/92	TOTAL	39	4		46	16	
ORE BLEND 2C	12/5/92	SUB200	28	2	].	24	11	
QUARTZITE A1/A2	12/5/92	TOTAL	0.4	0.5	U	0.2		υ

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CHEMICAL ANALYTICAL RESULTS FOR RADIOLOGICAL PARAMETERS IN SOURCE SAMPLES, MONSANTO PHA	SE II RI/FS
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LIVITUAL ANALT TICAL NE	SULIS FUN N	ADIOLOGICAL	- PANAMETER	13 IN SOUNC	E SAIN	ILEO, MUNDA	NIO PHAS	C 11 L/L
			LEAD-210			POLONIUM-210		
LOCATION	DATE	ANALYSIS	@46KeV	ERROR	QUAL	TOTAL	ERROR	QUAL
			pCi/G	(+/-)	1	pCi/G	(+/-)	ļ
			(dry)			(dry)		Ī
QUARTZITE A1/A2	12/5/92	SUB200	2		U	0.5	0.4	
QUARTZITE B1/B2	12/5/92	TOTAL	0.4	0.8	U	0.4	0.5	
QUARTZITE B1/B2	12/5/92	SUB200	1.5		ע	0.4		U
QUARTZITE C1/C2	12/5/92	TOTAL	0.3	0.7	Įυ	0.1	0.2	
QUARTZITE C1/C2	12/5/92	SUB200	2.1		U	0.3	0.3	
SLAG-1	10/28/91	SUB200	6.6	0.6		7	0.6	
SLAG-2	10/28/91	SUB200	1.2	0.3		0.3	0.4	U
SLAG-3	10/28/91	SUB200	6.6	0.6	l i	5.8	0.6	i
SLURRY-1	10/28/91	SUB200	37	1		23	1	ŀ
SLURRY-2	10/28/91	SUB200	29	1		24	1	
SLURRY-3	10/28/91	SUB200	120	10	1	100	10	l
TREATER DUST #1	12/14/92	SUB200	240	20		180	10	l
TREATER DUST #2	12/14/92	SUB200	370	40		250	10	l
TREATER DUST #3	12/14/92	SUB200	290	10		110	10	l
UNDERFLOW SOLIDS 1-1	10/28/91	SUB200	250	10	}	260	10	
UNDERFLOW SOLIDS 1-2	10/28/91	SUB200	260	10	1 1	99	5	
UNDERFLOW SOLIDS 1-3	10/28/91	SUB200	240	10	1 1	120	10	
UNDERFLOW SOLIDS 2-1	12/13/92	TOTAL	390	40	1	490	20	Į.
UNDERFLOW SOLIDS 2-2	12/14/92	TOTAL	230	20		290	20	ļ
UNDERFLOW SOLIDS 2-3	12/13/92	TOTAL	260	30		240	10	Ī





HEMICAL ANALYTICAL	RESULTS FOR	<u>R RADIOLOGIC</u>	CAL PARAMETERS IN S	OURCE SAI	MPLES,	MONSANTO	PHASE II	RI/F
			POTASSIUM-40			RADIUM-226		
LOCATION	DATE	ANALYSIS	@1460 KeV	ERROR	QUAL		ERROR	QUA
			pCi/G	(+/-)		pCi/G	(+/-)	1
			(dry)			(dry)	l	
BAGDUST-1	10/28/91	SUB200	1.6	0.5		1.2	0.2	
BAGDUST-2	10/28/91	SUB200	7.2	1.2		32	1	i
BAGDUST-3	10/28/91	SUB200	6.2	1	1	26	] 1	1
COKE PILE #1	12/13/92	TOTAL	0.43	1	U	0.24	0.15	1
COKE PILE #1	12/13/92	SUB200	0.24		U	1.3	0.9	1
COKE PILE #2	12/13/92	TOTAL	0.67	0.43		0.28	0.14	1
COKE PILE #2	12/13/92	SUB200	0	2.4		2.2	0.9	i
COKE PILE #3	12/13/92	TOTAL	О	0.35		0.07	0.13	
COKE PILE #3	12/13/92	SUB200	0	2.4		3.6	1.1	
FERROPHOS SLAG #1	12/16/92	TOTAL	0.59	0.52	U	3.9	0.4	
FERROPHOS SLAG #2	12/16/92	TOTAL	2	0.7	U	9.2	0.5	1
FERROPHOS SLAG #3	12/16/92	TOTAL	0.58	0.48	U	3.5	0.4	1
NEW NODULES #1	12/14/92	TOTAL	5	1.2	U	52	1	
NEW NODULES #2	12/14/92	TOTAL	4.9	1.4	Ιυ	48	1	
NEW NODULES #3	12/14/92	TOTAL	7.7	1.5		51	2	
NEW SLAG #1	12/14/92	TOTAL	5.6	1.3	υ	51	1	ł
NEW SLAG #2	12/14/92	TOTAL	6.4	1.3		44	1 1	1
NEW SLAG #3	12/14/92	TOTAL.	5.8	1	U	49	1	1
NEW TREATER DUST #1	12/13/92	TOTAL	67	2		22	1	l
NEW TREATER DUST #2	12/13/92	TOTAL	58	2		26	1 1	ł
NEW TREATER DUST #3	12/13/92	TOTAL	78	2		25	1	
OLD NODULES #1	12/14/92	SUB200	9.8	4.3	U	41	3	1
OLD NODULES #2	12/14/92	SUB200	4.6	4.4	Ū	42	3	
OLD NODULES #3	12/14/92	SUB200	4.4	4.4	Ŭ	40	3	
OLD SLAG #1	12/14/92	TOTAL	7.4	1.4	Ū	42	1	
OLD SLAG #2	12/14/92	TOTAL	7.6	1.4		47	2	
OLD SLAG #3	12/14/92	TOTAL	6.8	1.3	lυ	43	1	
ORE BLEND 1A	12/7/92	TOTAL	5.9	0.9	U	46	1	
ORE BLEND 1A	12/7/92	SUB200	10	1		34	l i	
ORE BLEND 1B	12/7/92	TOTAL	6	0.9	U	49	1	
ORE BLEND 1B	12/7/92	SUB200	10	1		28	1	
ORE BLEND 1C	12/7/92	TOTAL	5.6	1.1	l u	43	1	
ORE BLEND 1C	12/7/92	SUB200	9.9	1.3		34	i	
ORE BLEND 2A	12/5/92	TOTAL	7.7	1.4		43	1	1
ORE BLEND 2A	12/5/92	SUB200	14	1 7	1 :	30	1	1
ORE BLEND 2B	12/5/92	TOTAL	8.1	1.3	U	49	2	1
ORE BLEND 2B	12/5/92	SUB200	21	4	Ιŭ	28	2	1
ORE BLEND 2C	12/5/92	TOTAL	7	1.1	ľů	46	1	1
ORE BLEND 2C	12/5/92	SUB200	13	'i'		30	li	
QUARTZITE A1/A2	12/5/92	TOTAL	0.58	0.49		0.02	0.12	1

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CHEMICAL ANALYTICAL RESULTS FOR RADIOLOGICAL PARAMETERS IN SOURCE SAMPLES. MONSANTO PHASE II RI/FS	
CHEMICAL ANALTHCAL RESULTS FUN NADIULUGICAL PARAMETERS IN SUURCE SAMPLES. MUNSANTU PHASE II RIJES	

CHEMICAL ANALYTICAL	RESULTS FOR	RADIOLOGIC	CAL PARAMETERS IN SC	OURCE SAN	<u>/IPLES</u>	<u>MONSANTO</u>	PHASE II	RI/FS
			POTASSIUM-40			RADIUM-226		
LOCATION	DATE	ANALYSIS	@1460 KeV	ERROR	QUAL		ERROR	QUAL
			pCi/G	(+/-)		pCi/G	(+/-)	
			(dry)			(dry)		
QUARTZITE A1/A2	12/5/92	SUB200	5.6	2.7	}	0.7		U
QUARTZITE B1/B2	12/5/92	TOTAL	0.45	0.41	1	0.07	0.13	
QUARTZITE B1/B2	12/5/92	SUB200	2.4	ŀ	U	0.7	0.7	ļ .
QUARTZITE C1/C2	12/5/92	TOTAL	0.64	0.48		0.05	0.13	
QUARTZITE C1/C2	12/5/92	SUB200	5.5	2.9		0.3	0.7	[
SLAG-1	10/28/91	SUB200	6.6	1.4		43	1	
SLAG-2	10/28/91	SUB200	6.7	1.4		54	2	
SLAG-3	10/28/91	SUB200	6.8	1.4		46	2	i
SLURRY-1	10/28/91	SUB200	3.4	0.8		10	1	
SLURRY-2	10/28/91	SUB200	4.9	0.9		12	1	į
SLURRY-3	10/28/91	SUB200	9.8	1.2		17	1	1
TREATER DUST #1	12/14/92	SUB200	41	2	1	27	1	1
TREATER DUST #2	12/14/92	SUB200	68	2.		20	1	
TREATER DUST #3	12/14/92	SUB200	100	10		14	1	l
UNDERFLOW SOLIDS 1-1	10/28/91	SUB200	9.4	1.5	1	36	1	
UNDERFLOW SOLIDS 1-2	10/28/91	SUB200	11	1	ł	35	1	ļ
UNDERFLOW SOLIDS 1-3	10/28/91	SUB200	9.5	1.5		42	1	l
UNDERFLOW SOLIDS 2-1	12/13/92	TOTAL	11	1		36	1	1
UNDERFLOW SOLIDS 2-2	12/14/92	TOTAL	8.4	1.3		39	1	l
UNDERFLOW SOLIDS 2-3	12/13/92	TOTAL	10	1		39	1	l







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_	CHEWICAL ANAL	HOAL NESC	LIS FUN NAI	DIOLOGICAL	LVIVIAITI	LI (O II)	1 300nce 3A	IVII LLO, I	NUNSA	MICHIASLI	INIJ	
				RADIUM-228			THORIUM-228			THORIUM-230		<u> </u>
	LOCATION	DATE	ANALYSIS		ERROR	QUAL	TOTAL	ERROR	QUAL	TOTAL	ERROR	QUAL
				pCi/G	(+/-)		pCi/G	(+/-)	1	pCi/G	(+/-)	1
L				(dry)			(dry)	1	l	(dry)		
Г	BAGDUST-1	10/28/91	SUB200	0.2	0.2		0.1	0.2	U	1	0.3	U
1	BAGDUST-2	10/28/91	SUB200	0	0.3		0.4	0.2		33	2	1
1	BAGDUST-3	10/28/91	SUB200	0.4	0.2		0.3	0.2		24	2	1
1	COKE PILE #1	12/13/92	TOTAL				0.2		U	0.4	0.2	
	COKE PILE #1	12/13/92	SUB200	ŀ	<b>!</b>		0.4	0.3	į	0.6	0.3	
	COKE PILE #2	12/13/92	TOTAL		ŀ		0.2	0.2		0.8	0.3	1
	COKE PILE #2	12/13/92	SUB200				0.1	0.2		2.6	0.4	1
	COKE PILE #3	12/13/92	TOTAL	ŀ			0.1	0.1		0.2		lυ
	COKE PILE #3	12/13/92	SUB200				0.3	0.2	ł	3.9	0.5	
	FERROPHOS SLAG #1	12/16/92	TOTAL	İ	1	1	0.1		lυ	4.8	0.8	1
	FERROPHOS SLAG #2	12/16/92	TOTAL	]	•	1	0.1	0.1	Ū	9.7	0.9	
	FERROPHOS SLAG #3	12/16/92	TOTAL				0.1	0.1	Ü	4.7	0.8	i
	NEW NODULES #1	12/14/92	TOTAL		Ì		0.3	0.3		53	3	1
	NEW NODULES #2	12/14/92	TOTAL		]		0.4	0.5		55	4	}
	NEW NODULES #3	12/14/92	TOTAL		1	ł	0.3	0.3		50	3	
	NEW SLAG #1	12/14/92	TOTAL		1	i	0.4	0.6		51	4	
	NEW SLAG #2	12/14/92	TOTAL	•	]	1	0.4	0.4	l	39	3	
	NEW SLAG #3	12/14/92	TOTAL				0.5	0.6	1	57	4	
	NEW TREATER DUST #1	12/13/92	TOTAL				0.6	0.7		20	3	ł
	NEW TREATER DUST #2	12/13/92	TOTAL			1	0.1	0.3	1	24	2	
	NEW TREATER DUST #3	12/13/92	TOTAL		i	1	0.3	0.5		21	2	
	OLD NODULES #1	12/14/92	SUB200		]		0.5	0.2		53	2	
	OLD NODULES #2	12/14/92	SUB200				0.4	0.3		53	3	1
	OLD NODULES #3	12/14/92	SUB200				0.4	0.5	1	50	4	
	OLD SLAG #1	12/14/92	TOTAL		1		0.3	0.3		37	3	1
	OLD SLAG #2	12/14/92	TOTAL			i	0.1	0.4	İ	44	4	1
	OLD SLAG #3	12/14/92	TOTAL				0.6	0.6		40	4	1
	ORE BLEND 1A	12/7/92	TOTAL				0.2	0.1		49	2	1
	ORE BLEND 1A	12/7/92	SUB200	1			0.7	0.2		37	1	1
	ORE BLEND 1B	12/7/92	TOTAL	İ			0.7	0.3		58	2	}
	ORE BLEND 1B	12/7/92	SUB200	]			0.4	0.2		39	2	ł
	ORE BLEND 1C	12/7/92	TOTAL	i		l i	0.2	0.1	1	45	2 .	f
	ORE BLEND 1C	12/7/92	SUB200		ľ		0.4	0.2	ļ	37	1	l
	ORE BLEND 2A	12/5/92	TOTAL		i	i	0.3	0.2	i	44	2	ĺ
	ORE BLEND 2A	12/5/92	SUB200		ļ		0.6	0.2		33	1	
	ORE BLEND 2B	12/5/92	TOTAL			]	0.7	0.2		58	2	I
	ORE BLEND 2B	12/5/92	SUB200				0.4	0.3		32	1	
	ORE BLEND 2C	12/5/92	TOTAL			[	0.2	0.2		62	2	
	ORE BLEND 2C	12/5/92	SUB200				1	0.2	Ī	31	1	
	QUARTZITE A1/A2	12/5/92	TOTAL				0.1	0.3		0.2	0.2	

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CHEMICAL ANALY	TICAL RESU	<u>JLIS FOR RAL</u>	DIOLOGICAL	PARAMET	<u>ers in</u>	I SOURCE SA	MPLES, N	<u> 10NSA</u>	NTO PHASE I	I RI/FS
			RADIUM-228			THORIUM-228			THORIUM-230	
LOCATION	DATE	ANALYSIS		ERROR	QUAL	TOTAL	ERROR	QUAL	TOTAL	ERROR

					<del></del>		===, :				
		ļ	RADIUM-228	<u> </u>	L	THORIUM-228	<u> </u>		THORIUM-230		<u> </u>
LOCATION	DATE	ANALYSIS		ERROR	QUAL	TOTAL	ERROR	QUAL	TOTAL	ERROR	QUAL
	1		pCi/G	(+/-)		pCi/G	(+/-)	ļ	pCi/G	(+/-)	
			(dry)		<u> </u>	(dry)			(dry)		<u> </u>
QUARTZITE A1/A2	12/5/92	SUB200				0.2	0.2		0.2	0.2	
QUARTZITE B1/B2	12/5/92	TOTAL		ļ		0.1	0.1	<b>f</b>	0.5	0.2	
QUARTZITE B1/B2	12/5/92	SUB200				0.1	0.1	]	0.3	0.1	
QUARTZITE C1/C2	12/5/92	TOTAL			1	0.1	f	U	0.1		U
QUARTZITE C1/C2	12/5/92	SUB200			i l	0.2	0.1		0.3	0.1	
SLAG-1	10/28/91	SUB200	l 0	0.3		0.6	0.3		46	2	
SLAG-2	10/28/91	SUB200	0	0.3		0.3	0.3		40	3	
. SLAG-3	10/28/91	SUB200	0.7	0.3	1	5.1	2.9		430	20	]
SLURRY-1	10/28/91	SUB200	0.3	0.2		0.2	0.2	U	9.1	0.7	
SLURRY-2	10/28/91	SUB200	0	0.2		0.3	0.2		12	1	1
SLURRY-3	10/28/91	SUB200	0.5	0.3		0.6	0.3	ľ l	19	1	İ
TREATER DUST #1	12/14/92	SUB200				0.4	0.3		30	2	•
TREATER DUST #2	12/14/92	SUB200				0.1	0.2		17	1	]
TREATER DUST #3	12/14/92	SUB200			1	0.2		υ	8	0.7	ł
UNDERFLOW SOLIDS 1-1	10/28/91	SUB200	0.6	0.4		0.4	0.2		39	2	
UNDERFLOW SOLIDS 1-2	10/28/91	SUB200	1	0.4		0.5	0.3		38	2	ļ
UNDERFLOW SOLIDS 1-3	10/28/91	SUB200	0.4	0.3		0.4	0.2		44	2	
UNDERFLOW SOLIDS 2-1	12/13/92	TOTAL	•			0.3	0.4		40	2	
UNDERFLOW SOLIDS 2-2	12/14/92	TOTAL				0.7	0.9		45	4	t
UNDERFLOW SOLIDS 2-3	12/13/92	TOTAL				0.6		lυl	43	3	1



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CHEMICAL AMAL	- 1 11076 11606		JIOLOGICAL I	VIIVAIAIT I	יון טיו.	SOUTHER SA	VII LLO, IV	CINO	VIAI O I LIVOF I	1 111/1 5	
			THORIUM-232		<u> </u>	URANIUM-234			URANIUM-238		
LOCATION	DATE	ANALYSIS	TOTAL	ERROR	QUAL	TOTAL	ERROR	QUAL	TOTAL	ERROR	QUA
		i	pCi/G	( + <i> -</i> )	1	pCi/G	(+/-)	I	pCi/G	(+/-)	1
			(dry)		l	(dry)		l	(dry)		1
BAGDUST-1	10/28/91	SUB200	0.1	0.1				1	1.3	0.5	$\top$
BAGDUST-2	10/28/91	SUB200	0.4	0.2			Ī	ľ	35	4	
BAGDUST-3	10/28/91	SUB200	0.5	0.3			1	ŀ	24	3	
COKE PILE #1	12/13/92	TOTAL	0.2	0.1	1	0.3	0.1		0.3	0.1	
COKE PILE #1	12/13/92	SUB200	0.3	0.2	1	0.5	0.1		0.4	0.1	
COKE PILE #2	12/13/92	TOTAL	0.3	0.2	1	0.3	0.1		0.4	0.1	
COKE PILE #2	12/13/92	SUB200	0.1	0.1	1	2.1	0.5		2	0.5	
COKE PILE #3	12/13/92	TOTAL	0	0.1	1	0.2	""	lυ	0.1	0.1	
COKE PILE #3	12/13/92	SUB200	0.1	0.1		3.3	,	`	3.7	1	
FERROPHOS SLAG #1	12/16/92	TOTAL	<b></b>	•	ł	110	Ò		110	o	1
FERROPHOS SLAG #2	12/16/92	TOTAL				96	2	1	100	0	1
FERROPHOS SLAG #3	12/16/92	TOTAL				79	2		80	2	
NEW NODULES #1	12/10/92	TOTAL	0.4	0.3		49	2		48	2	
NEW NODULES #2	12/14/92	TOTAL	0.3	0.4		43	5	}	46	5	
NEW NODULES #3	12/14/92	TOTAL	0.4	0.3	ł	46	2	1	46	2	1
NEW SLAG #1	12/14/92	TOTAL	0.2	0.4		45	4		44	4	
NEW SLAG #2	12/14/92	TOTAL	0.6	0.4	1	40	2	1	45	3	1
NEW SLAG #3	12/14/92	TOTAL	0.5	0.5		38	4	İ	38	4	1
NEW TREATER DUST #1	12/13/92	TOTAL	0.5	0.5		17	5		16	5	1
NEW TREATER DUST #2	1	TOTAL	0.1			22	3	}	23	3	
NEW TREATER DUST #2	12/13/92		0.2	0.1		20	4	ì	18	4	
	12/13/92	TOTAL		0.2			†	ļ	40	1	1
OLD NODULES #1	12/14/92	SUB200	0.5	0.2		38		1			
OLD NODULES #2	12/14/92	SUB200	0.2	0.2		41	3 5	1	41	3 5	
OLD NODULES #3	12/14/92	SUB200	0.8	0.6		43	_		47		1
OLD SLAG #1	12/14/92	TOTAL	0.4	0.3	l	36	2		35	2	
OLD SLAG #2	12/14/92	TOTAL	0.3	0.4	1	36	3		40	3	
OLD SLAG #3	12/14/92	TOTAL	0.4	0.3	1	33	3		36	3	İ
ORE BLEND 1A	12/7/92	TOTAL	0.3	0.1	ļ	41	4		39	4	
ORE BLEND 1A	12/7/92	SUB200	0.5	0.2	1	30	3		30	3	
ORE BLEND 1B	12/7/92	TOTAL	1.3	0.3	İ	46	3		46	3	1
ORE BLEND 1B	12/7/92	SUB200	0.9	0.2		31	2	ł	31	2	}
ORE BLEND 1C	12/7/92	TOTAL	0.6	0.2	}	45	2		49	2	
ORE BLEND 1C	12/7/92	SUB200	0.5	0.2	1	32	1	1	34	1	
ORE BLEND 2A	12/5/92	TOTAL	0.2	0.1	İ	39	3		40	3	
ORE BLEND 2A	12/5/92	SUB200	0.4	0.2	ŀ	27	2	1	27	2	
ORE BLEND 2B	12/5/92	TOTAL	1.2	0.3		42	3	1	42	3	
ORE BLEND 2B	12/5/92	SUB200	0.7	0.2		25	3		26	3	
ORE BLEND 2C	12/5/92	TOTAL	0.9	0.3		37	3	I	40	3	1
ORE BLEND 2C	12/5/92	SUB200	0.6	0.2	1	27	3	l	30	3	
QUARTZITE A1/A2	12/5/92	TOTAL	0.1	0.1	L	0.1	I	U	0.1	1	U

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CHEMICAL ANALYTICAL RESULTS FOR RADIOLOGICAL PARAMETERS IN SOURCE SAMPLES, MONSANTO PHASE II RI/FS
----------------------------------------------------------------------------------------------------

			71020010/ IE 1	7 11 17 11 11 11 E 1 E		COUNTED COM	VIII EEO, IV	101101	MILO LINOL I	1 111/1 0	
			THORIUM-232			URANIUM-234			URANIUM-238	I	I
LOCATION	DATE	ANALYSIS	TOTAL	ERROR	QUAL	TOTAL	ERROR	QUAL	TOTAL	ERROR	QUAL
			pCi/G	(+/-)		pCi/G	(+/-)		pCi/G	(+/-)	1
			(dry)			(dry)	i		(dry)		1
QUARTZITE A1/A2	12/5/92	SUB200	0.2	0.1		0.2	0.1		0.3	0.1	
QUARTZITE B1/B2	12/5/92	TOTAL	0.1	0.1		0.2	0.1		0.1	0.1	Ιυ
QUARTZITE 81/B2	12/5/92	SUB200	0.3	0.1		0.3	0.1	]	0.2	0.1	lυ
QUARTZITE C1/C2	12/5/92	TOTAL	0.1	0.1		0.1	0.1		0.1	0.1	lυ
QUARTZITE C1/C2	12/5/92	SUB200	0.2	0.1		0.1	0.1		0.2	0.1	lυ
SLAG-1	10/28/91	SUB200	4.8	0.8	ł				41	5	1
SLAG-2	10/28/91	SUB200	0.1	0.1				1 1	47	4	
SLAG-3	10/28/91	SUB200	3.1	2.1					44	5	ļ
SLURRY-1	10/28/91	SUB200	0.3	0.1					10	2	1
SLURRY-2	10/28/91	SUB200	0.4	0.2			l		9.5	1.7	l
SLURRY-3	10/28/91	SUB200	1.6	0.4					9.9	1.6	
TREATER DUST #1	12/14/92	SUB200	0.7	0.3	1	21	2		24	2	1
TREATER DUST #2	12/14/92	SUB200	0.2	0.1		17	1		20	2	1
TREATER DUST #3	12/14/92	SUB200	0.1	0.1		6	0.7	1 1	7.6	0.8	1
UNDERFLOW SOLIDS 1-1	10/28/91	SUB200	0.6	0.2					31	4	1
UNDERFLOW SOLIDS 1-2	10/28/91	SUB200	0.2	0.2	1			1 1	34	4	1
UNDERFLOW SOLIDS 1-3	10/28/91	SUB200	0.2	0.1					41	5	1
<b>UNDERFLOW SOLIDS 2-1</b>	12/13/92	TOTAL	0.6	0.3	1 1	44	4		49	4	
<b>UNDERFLOW SOLIDS 2-2</b>	12/14/92	TOTAL	0.2	0.2		40	5		41	5	
<b>UNDERFLOW SOLIDS 2-3</b>	12/13/92	TOTAL	0.4	0.3		32	5		38	5	

## APPENDIX D QA/QC CONTROL FOR METEOROLOGICAL DATA

# QUALITY ASSURANCE/QUALITY CONTROL METEOROLOGICAL DATA MONSANTO SITE SODA SPRINGS, IDAHO

Installation and initial calibration of the instruments was conducted by Technical Environmental Enterprises, Inc. of Aurora, Colorado, on October 29, 1987. Routine equipment maintenance and calibration has been conducted on a six month interval by Technical Environmental Enterprises, Inc. Post-installation calibration reports are available for the following dates:

April 11-12, 1988
October 10-12, 1988
April 4-6, 1989
October 10-11, 1989
April 16, 1990
September 17-19, 1990
March 12, 1991
July 30, 1991

The system was judged to be collecting valid data within the limits of instrument specifications and to be in compliance with EPA PSD requirements from October, 1987, to October, 1988. The maintenance and calibration report for April, 1989, notes that minor electronic adjustments were made to some of the processors and that the wind vane at the 10 meter level was re-aligned to true north. The bearings were replaced on both anemometers since their starting torque was near the upper limit for obtaining wind speed data below 1 mph. Replacement of the battery pack was recommended and minor electronic drift in the computer A to D converter was noted. The drift was judged to be too small to have affected real time data and the system was reported to be collecting valid data in compliance with all known EPA requirements.

The battery pack was replaced during the following maintenance period in October, 1989, and minor electronic adjustments were made to some of the processors; none were reported to be out of compliance with EPA specifications. The computer A to D converter was calibrated and required no adjustments. The system was reported to be collecting data in compliance with all known EPA requirements, either for this maintenance period or for the subsequent period in April, 1990.

The routine calibration of the system in September, 1990, reported that the anemometer at the 10 meter level was found "locked up" due to a froze bearing. Examination of the data record indicates that the bearing seized at about 0100 hours on September 15, and was not functioning until 0900 on September 18; after the upper bearing in the 10 meter level anemometer had been replaced and the entire mechanism cleaned and re-assembled. Calibration testing of this sensor showed a "like new" condition. New heavy duty anemometer

cups were installed at both levels because the upper level cup set had become split and the lower level set was beginning to look border line for continued service. Minor electronic adjustments were made to some of the processors; none was out of compliance with EPA specifications. The system was reported to be collecting data in compliance with all known EPA requirements.

Technical Environmental Services (TES) Inc. (formerly Technical Environmental Enterprises, Inc.) conducted a calibration of the MIDAS system components in March 1991. Only minor electronic adjustments were required to bring the system into absolute compliance with the manufacturer's stated values. No "As Found" electronic values were beyond the acceptable range for accurate data collection. A minor defect in the temperature-difference card (SN 274) was repaired and the card was placed in the spares Tests of the temperature and temperature-difference compliment. systems were within  $\pm$  0.2°F. An end-to-end test of the system at zero and span values showed that data generated at the tower location was being correctly processed and displayed at the PC location where the MIDAS display is located. The MIDAS system was reported to be collecting data in accordance with EPA standards and practices as put forth in its PSD document.

A calibration of the MIDAS system was also carried out on July 30, 1991. No serious out-of- tolerance electronic values were detected, but the upper level anemometer was not operating due to "froze" bearings. Examination of the data record revealed that the anemometer had seized on June 24th. The bearings for the upper level sensor were replaced and the anemometer returned to service after testing to ensure that it met manufacturer's specifications. The lower level, 10 meter, anemometer was also removed and its bearings replaced as well. An end-to-end test of the system at zero and span values showed that the data generated at the tower location were being correctly processed and displayed on the MIDAS system, and the system was judged to be collecting data in accordance with EPA standards and practices as put forth in its PSD document.

Whereas the meteorological system instrumentation has performed well over the period of operations, the recording system on the IBM PC has experienced significant difficulties with respect to data storage on the computer disk drive. Substantial periods of the data record have been irretrievably lost. There was insufficient data to compute seasonal averages for the period January to September, 1988, as well as for January to March 1989, and October to December, 1989. The 1990 data set was essentially complete, with a total of only 41 missing hours (<0.5%). In addition, there were 81 hours of missing wind speed data for the 10 meter level anemometer due to the seized bearing referred to above. The complete 1991 data set was not yet available when the modeling study was initiated. Therefore, the 1990 data set was the most suitable for use in dispersion modeling assessment. The 41 hours

of missing data were replaced using the EPA recommended methods as described in EPA (1990). The 81 hours of missing wind speed data during the period of seized bearings (September 15-18) was treated as calms (i.e. 1 m/s wind speed), and thus would tend to overestimate actual predicted concentrations during this period.

In order to test the quality of the data set, the 1990 data were evaluated using the EPA's Meteorological Processor for Regulatory Models (MPRM-1.2). The MPRM program is a general purpose computer processor for screening and organizing raw meteorological data into a format suitable for use by EPA approved guideline models. An unique feature of the processor is the ability to accept and perform quality assessment of user-collected meteorological data as well as data routinely collected by the National Weather Service. The MPRM-1.2 will support the following dispersion models:

- those requiring RAMMET formatted data such as BLP, RAM, ISCST, MPTER, CRSTER and COMPLEX1;
- those requiring STAR formatted data such as CDM, ISCLT and VALLEY; and
- those requiring special formats such as CALINE 3 and RTDM (default).

The MPRM program is essentially a three stage system. The first stage retrieves the meteorological data from the computer file and processes the data through various quality assessment checks. The second stage collects the data available for a 24-hour period (eg. upper air observations, hourly surface observations, etc.) and stores these data in a combined (merged) format. The third stage reads the merged meteorological data and performs the necessary processing to prepare a meteorological data file suitable for use with the specific dispersion model being used.

MPRM-1.2 testing of the 1990 data set from the Monsanto station revealed that there were a total of 758 (8.65%) violations of the upper bound limit of acceptable values for standard deviation of the wind direction (used in calculating atmospheric stability classes) at the 10 meter level, and 599 violations (6.84%) of the upper bound standard deviation limit for the 37 meter level. There were no violations of the wind direction sensor at either level, but 101 and 99 violations (1.15% and 1.13%) of the lower bound limit for the wind speed at the 10 meter and 37 meter levels, respectively. There were also a total of 29 violations of the lower bound limit (i.e., <-30°C) of the temperature sensor at the 10 meter level which occurred from 2400 hrs on December 21 to 1200 on December 22, from 0300 hrs to 1000 hrs on December 23, and from 2200 hrs on December 29 to 0500 on December 30. The MPRM-1.2 audit trail also lists a large number of violations (6063 hrs) for the temperature difference ( $\Delta T$ ) values. However, this is an erroneous assessment because the MPRM-1.2 program is designed to evaluate data from 10 meter towers, and the  $\Delta T$  for the Monsanto data between

the 10 meter and 37 meter heights will naturally exceed the  $\Delta T$  normally expected for a 10 meter tower. Since these data were not used in computing atmospheric stability classes, the lack of quality assurance testing by the MPRM-1.2 program on the  $\Delta T$  data is not relevant.

Therefore, for the 10 meter level data used in dispersion modeling, the MPRM-1.2 assessment of the data quality is as follows:

<u>Parameter</u>	<pre>% Accepted (MPRM-1.2)</pre>
Standard deviation of wind direction	91.35
Temperature	99.67
Wind Direction	100.0
Wind Speed	98.85

A copy of the MPRM-1.2 audit for the 1990 data set is attached. With the 81 hours of missing wind speed data caused by the seized bearing, the percentage of acceptable wind speed data would be 97.93%. However, these data were treated as calms, and were included in the modeling computations.

## APPENDIX E AIR QUALITY MONITORING

TABLE E-1

AVERAGE ANNUAL TSP CONCENTRATIONS (µg/m³)

Discrete Re	eceptors	Source	Slag	Source	Source		
Coordina	· ·	Group 1	Dumping	Group 2	Group 3	FDM	Total
	Northing (m)	TSP	TSP	TSP	TSP	TSP	TSP
450550	4725235	0.35	0.05	0.15	1.59	1.05	3.14
451975	4724880	1.92	0.55	0.87	6.58	10.26	19.63
452220	4724880	1.15	0.21	0.57	4.32	5.00	11.04
452135	4724610	1.22	0.29	0.56	4.90	4.82	11.49
452200	4724150	1.00	0.28	0.40	4.20	2.90	8.51
453730	4728135	0.31	0.04	0.08	1.25	0.36	2.00
451440	4723255	1.10	0.34	0.36	4.63	2.21	8.31
451200	4722255	0.82	0.21	0.24	3.53	1.23	5.82
450710	4721855	0.76	0.18	0.21	3.27	1.05	5.29
450805	4723000	1.07	0.31	0.33	4.53	1.86	7.79
449762	4728714	0.46	0.05	0.08	1.46	0.37	2.38
451523	4724809	3.06	1.64	0.98	8.55	11.88	24.47
450250	4722283	0.81	0.18	0.23	3.63	1.14	5.81
454756	4731024	0.18	0.02	0.04	0.69	0.15	1.06
454000	4732300	0.20	0.02	0.04	0.74	0.14	1.13
452075	4723300	0.87	0.22	0.30	3.85	1.96	7.00
453930	4726815	0.33	0.04	0.10	1.46	0.38	2.27
455600	4727000	0.15	0.02	0.03	0.57	0.12	0.87
455425	4728250	0.20	0.02	0.04	0.73	0.15	1.12
454390	4732500	0.18	0.02	0.03	0.66	0.13	1.00
454950	4732340	0.16	0.02	0.03	0.58	0.11	0.88
451450	4732695	0.30	0.03	0.06	1.05	0.21	1.62
450390	4732610	0.30	0.03	0.05	1.01	0.19	1.56
449290	4732270	0.30	0.03	0.05	0.97	0.19	1.51
449850	4730725	0.42	0.04	0.07	1.35	0.30	2.14
451250	4730725	0.45	0.05	0.09	1.57	0.37	2.49
451085	4730300	0.50	0.05	0.10	1.73	0.44	2.77
449000	4729250	0.31	0.04	0.05	0.97	0.22	1.55
449875	4726200	0.13	0.05	0.05	0.50	0.38	1.06
449750	4727650	0.37	0.06	0.07	1.19	0.36	1.99
450560	4725650	0.23	0.07	0.08	0.57	0.85	1.73
450675	4724660	0.85	0.14	0.32	3.62	1.70	6.48
452258	4724935	1.05	0.15	0.55	3.95	4.78	10.33
452538	4726026	0.56	0.16	0.17	0.98	5.26	6.96
451368	4726164	1.08	0.44	0.26	0.86	5.10	7.30
452133	4727026	1,24	0.16	0.53	6.46	10.30	18.53

Note: Total = Source Group 1 + Source Group 2 + Source Group 3 + FDM

Source Group 1 - Permitted sources, plus slag dumping

Source Group 2 - Baghouses/furnace building fugitives

Source Group 3 - Nodule reclaim area

FDM - Roads/material handling operations/wind erosion

TABLE E-2

AVERAGE ANNUAL PM10 CONCENTRATIONS (µg/m³)

Discrete I	Receptors	Source	Clas				
Coordin		Group 1	Slag	Source	Source		
	Northing (m)	PM10	Dumping	Group 2	Group 3	FDM	Total
450550	4725235		PM10	PM10	PM10	PM10	PM10
451975	4725235	0.24	0.03	0.09	1.74	0.8	
452220	4724880	1.47	0.29	0.54	7.99	6.07	16.07
452135	4724610	0.88	0.11	0.36	5.12	3.23	9.59
452200	4724150	0.92	0.15	0.35	5.41	3.15	
453730	4724150	0.72	0.14	0.25	4.10	1.97	
451440	4723255	0.19	0.02	0.05	0.84	0.27	
451200	4723255	0.75	0.18	0.21	3.82	1.38	, ,,,,,,,
450710		0.54	0.11	0.14	2.61	0.79	
450805	4721855	0.50	0.09	0.13	2.33	0.69	,
449762	4723000	0.71	0.16	0.20	3.55	1.21	5.68
451523	4728714	0.25	0.03	0.05	0.97	0.26	
450250	4724809	2.06	0.85	0.60	10.01	6.91	19.58
454756	4722283	0.53	0.09	0.14	2.62	0.77	4.06
454000	4731024	0.10	0.01	0.02	0.42	0.12	0.66
452075	4732300	0.12	0.01	0.02	0.48	0.10	0.72
453930	4723300	0.61	0.11	0.19	3.24	1.28	5.32
455600	4726815	0.20	0.02	0.06	0.98	0.25	1.49
455425	4727000	0.09	0.01	0.02	0.35	0.08	0.54
454390	4728250	0.11	0.01	0.02	0.45	0.12	0.70
454390 454950	4732500	0.10	0.01	0.02	0.43	0.09	0.64
454950 451450	4732340	0.09	0.01	0.02	0.35	0.08	0.54
	4732695	0.16	0.02	0.03	0.67	0.15	1.01
450390	4732610	0.16	0.01	0.03	0.59	0.13	0.91
449290 449850	4732270	0.16	0.01	0.03	0.51	0.14	0.84
	4730725	0.22	0.02	0.04	0.71	0.22	1.20
451250	4730725	0.24	0.02	0.05	1.02	0.27	1.58
451085	4730300	0.26	0.03	0.06	1.09	0.31	1.72
449000	4729250	0.17	0.02	0.03	0.69	0.16	1.05
449875	4726200	0.09	0.02	0.03	0.53	0.26	0.91
449750	4727650	0.21	0.03	0.04	0.84	0.24	1.34
450560	4725650	0.16	0.04	0.05	0.71	0.58	1.49
450675	4724660	0.62	0.07	0.19	3.59	1.14	
452258	4724935	0.81	0.08	0.35	4.73	3.06	5.53 8.94
452538	4726026	0.39	0.08	0.11	1.36	4.21	
451368	4726164	0.76	0.23	0.16	2.92	3.29	6.07
452133	4727026	0.73	0.08	0.35	7.18	7.64	7.13 15.89

Note: Total = Source Group 1 + Source Group 2 + Source Group 3 + FDM

Source Group 1 - Permitted sources, plus slag dumping

Source Group 2 - Baghouses/furnace building fugitives

Source Group 3 - Nodule reclaim area

FDM - Roads/material handling operations/wind erosion

TABLE E-3

ANNUAL CADMIUM CONCENTRATIONS (µg/m²)

Discrete F	Receptors	Source	Slag	Source	Source		
1	inates	Group 1	Dumping	Group 2	Group 3	FDM	Total
	Northing (m)	Cadmium	Cadmium	Cadmium	Cadmium	Cadmium	Cadmium
450550	4725235	0.0043	0.0000	0.0000	0.0000	0.00007	0.00437
451975	4724880	0.0098	0.0000	0.0003	0.0000	0.00039	0.01049
452220	4724880	0.0074	0.0000	0.0002	0.0000	0.00033	0.00793
452135	4724610	0.0089	0.0000	0.0002	0.0000	0.00027	0.00937
452200	4724150	0.0092	0.0000	0.0001	0.0000	0.00018	0.00948
453730	4728135	0.0055	0.0000	0.0000	0.0000	0.00003	0.00553
451440	4723255	0.0132	0.0000	0.0001	0.0000	0.00012	0.01342
451200	4722255	0.0122	0.0000	0.0001	0.0000	0.00007	0.01237
450710	4721855	0.0122	0.0000	0.0001	0.0000	0.00006	0.01236
450805	4723000	0.0144	0.0000	0.0001	0.0000	0.00010	0.01460
449762	4728714	0.0074	0.0000	0.0000	0.0000	0.00002	0.00742
451523	4724809	0.0137	0.0000	0.0003	0.0000	0.00037	0.01437
450250	4722283	0.0137	0.0000	0.0001	0.0000	0.00007	0.01387
454756	4731024	0.0037	0.0000	0.0000	0.0000	0.00001	0.00371
454000	4732300	0.0040	0.0000	0.0000	0.0000	0.00001	0.00401
452075	4723300	0.0106	0.0000	0.0001	0.0000	0.00011	0.01081
453930	4726815	0.0044	0.0000	0.0000	0.0000	0.00002	0.00442
455600	4727000	0.0023	0.0000	0.0000	0.0000	0.00001	0.00231
455425	4728250	0.0041	0.0000	0.0000	0.0000	0.00001	0.00411
454390	4732500	0.0036	0.0000	0.0000	0.0000	0.00001	0.00361
454950	4732340	0.0033	0.0000	0.0000	0.0000	0.00001	0.00331
451450	4732695	0.0055	0.0000	0.0000	0.0000	0.00002	0.00552
450390	4732610	0.0054	0.0000	0.0000	0.0000	0.00002	0.00542
449290	4732270	0.0052	0.0000	0.0000	0.0000	0.00001	0.00521
449850	4730725	0.0071	0.0000	0.0000	0.0000	0.00002	0.00712
451250	4730725	0.0076	0.0000	0.0000	0.0000	0.00003	0.00763
451085	4730300	0.0084	0.0000	0.0000	0.0000	0.00004	0.00844
449000	4729250	0.0051	0.0000	0.0000	0.0000	0.00001	0.00511
449875	4726200	0.0007	0.0000	0.0000	0.0000	0.00002	0.00072
449750	4727650	0.0054	0.0000	0.0000	0.0000	0.00002	0.00542
450560	4725650	0.0022	0.0000	0.0000	0.0000	0.00005	0.00225
450675	4724660	0.0112	0.0000	0.0001	0.0000	0.00011	0.01141
452258	4724935	0.0068	0.0000	0.0002	0.0000	0.00034	0.00734
452538	4726026	0.0025	0.0000	0.0000	0.0000	0.00051	0.00301
451368	4726164	0.0049	0.0000	0.0001	0.0000	0.00021	0.00521
452133	4727026	0.0114	0.0000	0.0002	0.0000	0.00289	0.01449

Note: Total = Source Group 1 + Source Group 2 + Source Group 3 + FDM.

Source Group 1 - Permitted sources, plus slag dumping

Source Group 2 - Baghouse/furnace building fugitives

Source Group 3 - Nodule Reclaim Area

FDM - Roads/material handling operations/wind erosion

TABLE E-4

ANNUAL FLUORIDE CONCENTRATIONS (µg/m³)

Discrete	Receptors	Source	Slag	Source	Source		
	linates	Group 1	Dumping	Group 2	Group 3	FDM	Total
	Northing (m)	Fluoride	Fluoride	Fluoride	Fluoride	Fluoride	Fluoride
450550	4725235	0.0712	0.0135	0.0030	0.0256	0.00844	0.10824
451975	4724880	0.5290	0.1368	0.0179	0.1177	0.06639	0.73099
452220	4724880	0.3012	0.0525	0.0114	0.0758	0.04156	0.42996
452135	4724610	0.3156	0.0715	0.0111	0.0797	0.03699	0.44339
452200	4724150	0.2403	0.0688	0.0082	0.0601	0.02332	0.33192
453730	4728135	0.0456	0.0099	0.0017	0.0122	0.00327	0,06277
451440	4723255	0.2382	0.0849	0.0078	0.0557	0.01643	0.31813
451200	4722255	0.1574	0.0510	0.0053	0.0380	0.00961	0.21031
450710	4721855	0.1391	0.0439	0.0047	0.0338	0.00798	0.18558
450805	4723000	0.2190	0.0772	0.0072	0.0517	0.01368	0.29158
449762	4728714	0.0531	0.0132	0.0017	0.0143	0.00299	0.07209
451523	4724809	0.8066	0.4046	0.0206	0.1466	0.06940	1.04320
450250	4722283	0.1441	0.0440	0.0051	0.0381	0.00863	0.19593
454756	4731024	0.0215	0.0047	0.0008	0.0061	0.00130	0.02970
454000	4732300	0.0242	0.0052	0.0008	0.0069	0.00126	0.03316
452075	4723300	0.1898	0.0546	0.0063	0.0473	0.01448	0.25788
453930	4726815	0.0521	0.0109	0.0019	0.0142	0.00336	0.07156
455600	4727000	0.0214	0.0059	0.0007	0.0051	0.00087	0.02807
455425	4728250	0.0239	0.0049	0.0009	0.0065	0.00140	0.03270
454390	4732500	0.0216	0.0046	0.0007	0.0062	0.00111	0.02961
454950	4732340	0.0181	0.0039	0.0006	0.0051	0.00099	0.02479
451450	4732695	0.0339	0.0074	0.0012	0.0097	0.00184	0.04664
450390	4732610	0.0325	0.0071	0.0011	0.0085	0.00169	0.04379
449290	4732270	0.0319	0.0068	0.0011	0.0074	0.00162	0.04202
449850	4730725	0.0447	0.0098	0.0015	0.0103	0.00257	0.05907
451250	4730725	0.0509	0.0113	0.0019	0.0148	0.00336	0.07096
451085	4730300	0.0563	0.0125	0.0021	0.0158	0.00393	0.07813
449000	4729250	0.0365	0.0090	0.0011	0.0101	0.00180	0.04950
449875	4726200	0.0324	0.0117	0.0010	0.0078	0.00297	0.04417
449750	4727650	0.0491	0.0146	0.0014	0.0123	0.00270	0.06550
450560	4725650	0.0510	0.0172	0.0014	0.0104	0.00639	0.06919
450675	4724660	0.1780	0.0346	0.0070	0.0526	0.01407	0.25167
452258	4724935	0.2737	0.0382	0.0110	0.0702	0.04071	0.39561
452538	4726026	0.1378	0.0385	0.0032	0.0207	0.04452	0.20622
451368	4726164	0.2805	0.1096	0.0051	0.0421	0.03201	0.35971
452133	4727026	0.2182	0.0404	0.0102	0.1054	0.13433	0.46813

Note: Total = Source Group 1 + Source Group 2 + Source Group 3 + FDM

Source Group 1 - Permitted Sources, plus slag dumping

Source Group 2 - Baghouses/furnace building fugitives

Source Group 3 - Nodule Reclaim Area

TABLE E-5
SECOND HIGHEST 24-HOUR TSP CONCENTRATIONS (µg/m³)

Discrete Re	ceptors	Source	Source	Source	
Coordinat	tes	Group 1	Group 2	Group 3	FDM
Easting (m)	Northing (m)	TSP	TSP	TSP	TSP
450550	4725235	2.62	1.25	24.16	2.62
451975	4724880	6.37	3.66	70.42	16.17
452220	4724880	5.57	3.01	75.57	9.55
452135	4724610	6.24	2.18	54.36	10.34
452200	4724150	5.17	1.70	40.47	7.28
453730	4728135	2.38	1.26	17.38	2.42
451440	4723255	4.61	1.55	33.02	5.43
451200	4722255	3.32	1.08	25.93	3.37
450710	4721855	3.62	1.16	26.22	3.12
450805	4723000	6.18	2.09	42.78	5.48
449762	4728714	3.90	0.94	25.19	0.60
451523	4724809	15.40	4.95	92.70	27.46
450250	4722283	4.95	1.60	36.94	3.53
454756	4731024	1.78	0.51	10.66	0.83
454000	4732300	1.80	0.41	10.98	0.79
452075	4723300	3.73	1.29	27.49	3.72
453930	4726815	3.64	1.32	31.88	2.01
455600	4727000	1.81	0.78	15.40	0.76
455425	4728250	2.25	1.22	23.51	1.06
454390	4732500	1.85	0.37	10.21	0.69
454950	4732340	1.38	0.30	9.01	0.66
451450	4732695	2.02	0.48	11.29	0.41
450390	4732610	1.81	0.39	9.23	0.29
449290	4732270	1.53	0.35	9.67	0.23
449850	4730725	2.05	0.43	12.33	0.34
451250	4730725	3.06	0.61	13.85	0.61
451085	4730300	2.90	0.61	15.14	0.62
449000	4729250	3.22	0.84	17.78	0.35
449875	4726200	1.04	0.61	17.51	1.35
449750	4727650	1.71	0.52	15.64	0.81
450560	4725650	3.22	0.96	16.98	3.53
450675	4724660	3.96	2.10	43.19	6.67
452258	4724935	6.48	3.10	65.23	9.01
452538	4726026	6.88	2.66	37.81	8.34
451368	4726164	3.90	0.88	30.25	12.38
452133	4727026	6.11	3.67	104.71	17.84

Source Group 2 - Baghouses/furnace building fugitives

Source Group 3 - Nodule reclaim area

TABLE E-6
SECOND HIGHEST 24-HOUR PM10 CONCENTRATION (µg/m²)

Discrete Rec	ceptors	Source	Source	Source	<u> </u>
Coordin	ates	Group 1	Group 2	Group 3	FDM
Easting (m)	Northing (m)	PM10	PM10	PM10	PM10
450550	4725235	2.31	0.89	11.46	1.80
451975	4724880	5.04	2.19	34.51	9.79
452220	4724880	4.22	1.87	36.82	6.73
452135	4724610	4.29	1.40	26.73	6.40
452200	4724150	3.46	1.09	19.71	4.56
453730	4728135	1.59	0.85	8.55	1.74
451440	4723255	3.02	0.95	16.11	3.54
451200	4722255	2.16	0.67	12.73	2.23
450710	4721855	2.50	0.69	12.86	2.08
450805	4723000	4.26	1.26	21.05	3.56
449762	4728714	2.27	0.56	12.31	0.39
451523	4724809	11.06	3.08	45.32	16.32
450250	4722283	3.35	0.95	18.18	2.37
454756	4731024	1.07	0.34	5.25	0.60
454000	4732300	1.14	0.27	5.37	0.57
452075	4723300	2.51	0.79	13.41	2.27
453930	4726815	2.32	0.85	15.63	1.35
455600	4727000	1.23	0.47	7.55	0.48
455425	4728250	1.74	0.70	11.51	0.80
454390	4732500	1.07	0.23	5.03	0.50
454950	4732340	0.79	0.21	4.43	0.48
451450	4732695	0.98	0.32	5.54	0.29
450390	4732610	0.97	0.26	4.53	0.21
449290	4732270	0.80	0.23	4.72	0.16
449850	4730725	1.16	0.30	6.04	0.25
451250	4730725	1.60	0.37	6.75	0.43
451085	4730300	1.46	0.41	7.42	0.44
449000	4729250	1.81	0.54	8.60	0.25
449875	4726200	0.78	0.42	8.54	0.95
449750	4727650	1.14	0.33	7.70	0.55
450560	4725650	1.53	0.66	8.34	2.09
450675	4724660	3.25	1.38	20.93	4.73
452258	4724935	4.12	2.00	32.15	6.49
452538	4726026	5.51	1.38	18.72	5.62
451368	4726164	3.55	0.57	14.76	9.30
452133	4727026	4.44	2.50	51.32	14.01

Source Group 2 - Baghouses/furnace building fugitives

Source Group 3 - Nodule reclaim area

TABLE E-7
SECOND HIGHEST 24-HOUR CADMIUM CONCENTRATIONS (µg/m³)

Discrete Re	eceptors	Source	Source	Source	
Coordin		Group 1	Group 2	Group 3	FDM
Easting (m)	Northing (m)	Cadmlum	Cadmium	Cadmium	Cadmium
450550	4725235	0.0234	0.0003	0.0000	0.0002
451975	4724880	0.0845	0.0014	0.0001	0.0008
452220	4724880	0.1165	0.0010	0.0001	0.0006
452135	4724610	0.0917	0.0008	0.0001	0.0005
452200	4724150	0.0858	0.0006	0.0001	0.0003
453730	4728135	0.0583	0.0003	0.0000	0.0003
451440	4723255	0.0678	0.0005	0.0001	0.0003
451200	4722255	0.0611	0.0004	0.0000	0.0002
450710	4721855	0.0587	0.0004	0.0000	0.0002
450805	4723000	0.0653	0.0008	0.0001	0.0003
449762	4728714	0.1106	0.0004	0.0000	0.0000
451523	4724809	0.0719	0.0017	0.0002	0.0011
450250	4722283	0.0772	0.0006	0.0001	0.0002
454756	4731024	0.0329	0.0002	0.0000	0.0001
454000	4732300	0.0415	0.0001	0.0000	0.0001
452075	4723300	0.0594	0.0005	0.0001	0.0002
453930	4726815	0.0651	0.0005	0.0001	0.0001
455600	4727000	0.0338	0.0003	0.0000	0.0000
455425	4728250	0.0447	0.0005	0.0000	0.0001
454390	4732500	0.0422	0.0001	0.0000	0.0001
454950	4732340	0.0332	0.0001	0.0000	0.0001
451450	4732695	0.0303	0.0001	0.0000	0.0000
450390	4732610	0.0293	0.0001	0.0000	0.0000
449290	4732270	0.0297	0.0001	0.0000	0.0000
449850	4730725	0.0377	0.0001	0.0000	0.0000
451250	4730725	0.0502	0.0002	0.0000	0.0000
451085	4730300	0.0454	0.0002	0.0000	0.0001
449000	4729250	0.0507	0.0003	0.0000	0.0000
449875	4726200	0.0146	0.0002	0.0000	0.0002
449750	4727650	0.0259	0.0002	0.0000	0.0001
450560	4725650	0.0174	0.0003	0.0000	0.0001
450675	4724660	0.0519	0.0006	0.0001	0.0006
452258	4724935	0.1372	0.0010	0.0001	0.0007
452538	4726026	0.0656	0.0014	0.0001	0.0011
451368	4726164	0.0265	0.0005	0.0001	0.0007
452133	4727026	0.1205	0.0010	0.0002	0.0035

Source Group 2 - Baghouses/furnace building fugitives

Source Group 3 - Nodule reclaim area

TABLE E-8
SECOND HIGHEST 24-HOUR FLUORIDE CONCENTRATIONS (µg/m³)

Discrete l	Receptors	Source	Source	Source	
Coordi	nates	Group 1	Group 2	Group 3	FDM
Easting (m)	Northing (m)	Fluoride	Fluoride	Fluoride	Fluoride
450550	4725235	0.7500	0.0210	0.1728	0.0181
451975	4724880	1.8450	0.0819	0.5038	0.1121
452220	4724880	1.4069	0.0611	0.5407	0.0889
452135	4724610	1.1880	0.0462	0.3890	0.0717
452200	4724150	1.0082	0.0358	0,2896	0.0519
453730	4728135	0.5505	0.0217	0.1244	0.0212
451440	4723255	0.9138	0.0326	0.2363	0.0427
451200	4722255	0.6486	0.0234	0.1856	0.0268
450710	4721855	0.7350	0.0250	0.1876	0.0247
450805	4723000	1.3969	0.0451	0.3061	0.0419
449762	4728714	0.5176	0.0207	0.1803	0.0048
451523	4724809	4.4551	0.1011	0.6633	0.1766
450250	4722283	0.9495	0.0357	0.2644	0.0290
454756	4731024	0.2728	0.0104	0.0763	0.0075
454000	4732300	0.2151	0.0076	0.0786	0.0071
452075	4723300	0.7440	0.0284	0.1967	0.0266
453930	4726815	0.8264	0.0290	0.2281	0.0201
455600	4727000	0.3939	0.0161	0.1102	0.0055
455425	4728250	0.5387	0.0294	0.1682	0.0101
454390	4732500	0.2133	0.0078	0.0731	0.0062
454950	4732340	0.1748	0.0059	0.0645	0.0060
451450	4732695	0.2209	0.0087	0.0808	0.0036
450390	4732610	0.2024	0.0076	0.0660	0.0027
449290	4732270	0.1612	0.0063	0.0692	0.0020
449850	4730725	0.2033	0.0076	0.0882	0.0031
451250	4730725	0.3428	0.0137	0.0991	0.0053
451085	4730300	0.3716	0.0142	0.1084	0.0056
449000	4729250	0.3246	0.0164	0.1272	0.0032
449875	4726200	0.2900	0.0126	0.1253	0.0145
449750	4727650	0.4640	0.0117	0.1119	0.0080
450560	4725650	0.5627	0.0184	0.1216	0.0257
450675	4724660	1.0657	0.0392	0.3090	0.0623
452258	4724935	1.1794	0.0596	0.4667	0.0929
452538	4726026	2.3645	0.0721	0.2705	0.0948
451368	4726164	1.0858	0.0275	0.2164	0.1476
452133	4727026	1.6531	0.0626	0.7493	0.2584

Source Group 2 - Baghouses/furnace building fugitives

Source Group 3 - Nodule reclaim area

## APPENDIX E-1 STACK SAMPLING PROGRAM SUMMARY

A stack sampling program was conducted at the Monsanto plant during the period August 9-16, 1994. Samples were collected from the following sources:

kiln cooler spray tower (KCST) - trace metal and radionuclide analysis nodule crushing and screening - trace metal and radionuclide analysis

scrubber (NCSS)
tanhole fume collector #7 (THEC)

taphole fume collector #7 (THFC) - trace metal, radionuclide analysis and

fluoride analysis

taphole fume collectors #8 & 9 - fluoride analysis kiln venturi scrubbers (KVS) - radionuclide analysis

The THFC sampling results also affect the estimated emissions for furnace building fugitives and for slag disposal operations on the slag stockpile.

Tables 1 through 3 list the re-calculated emission rates for these sources based on the new sampling data, as well as the Phase II RI emission rates used in dispersion modelling for comparison. The results are discussed below. Note that the trace metal analysis did not include vanadium and molybdenum.

Kiln Cooler Spray Tower (Table 1) - Trace metal analysis indicated significantly higher emissions of arsenic (As), cadmium (Cd), silver (Ag) and zinc (Zn). Emissions of manganese (Mn) were as expected, and beryllium (Be) was below detection limits.

Emissions of the non-volatile radionuclides radium-226 (Ra-226), thorium-230 (Th-230), uranium-234 (U-234) and uranium-238 (U-238) were as expected, but emissions of lead-210 (Pb-210) and polonium-210 (Po-210) were significantly underestimated in the Phase II RI for this source.

Fluoride emissions have been previously measured for this source, and therefore were not included in the sampling program.

<u>Nodule Crushing/Screening Scrubber</u> (Table 1) - Trace metal emissions were generally lower than estimated for the Phase II RI, except for the Zn emissions. In fact, emissions of As, Be, Cd, and Ag were below detection limits.

Similarly, emissions of Po-210, Th-230, U-234 and U-238 were much lower than estimated for the Phase II RI, while Ra-226 emissions were as expected. Only Pb-210 emissions were significantly higher than expected.

<u>Taphole Fume Collectors</u> (Table 1) - Emissions of As and Ag were higher than expected, while emissions of Cd were lower than expected. Be was below detection limits, while Mn and Zn were about the same as estimated for the Phase II RI.

Emissions of the non-volatile radionuclides were determined to be low, similar to the estimated emissions used for the Phase II RI. Emissions of Po-210 were somewhat lower than expected, while emissions of Pb-210 were slightly higher. However, both Po-210 and Pb-210 were within a factor 2 of anticipated emission rates.

The measured fluoride emissions for all three THFC's were much lower than has been historically reported by Monsanto.

<u>Furnace Building Fugitives</u> (Table 2) - The new sampling data for the THFC's was used to recalculate fugitive emissions from the furnace building. The results indicate somewhat higher emissions of As and Ag than had previously been estimated, and somewhat lower fluoride emissions. Pb-210 emissions are slightly higher, while Po-210 are slightly lower. However, in general, radionuclide emissions are similar to those which were used in the Phase II RI.

<u>Hot Slag Disposal</u> (Table 2) - The new sampling data for the THFC's was also used to recalculate fugitive emissions from the slag disposal operations. Previously, these emissions were based on the concentrations of trace constituents in the cold slag from source sampling.

Trace metal emissions of As, Ag and Zn are significantly higher than previously estimated. In the case of Zn, the new emission estimates are three orders of magnitude higher than was used in the Phase II RI. Emissions of Be are lower than expected, while emissions of Cd are essentially unchanged.

Emissions of the non-volatile radionuclides are somewhat lower than previously estimated, but the difference is less than a factor of 2. On the other hand, emissions of both Po-210 and Pb-210 are much higher than previously estimated.

Emissions of fluoride are significantly lower than previously determined, in line with the lower emissions from the THFC's and the furnace building fugitives.

<u>Kiln Venturi Scrubbers</u> (Table 3) - Trace metal and fluoride emissions have been previously measured for these four stacks and were not included in the new stack sampling program.

Estimated emissions of Po-210 and the non-volatile radionuclides were as anticipated, while emissions of Pb-210 were about 50% higher than previously estimated.

The significance of these changes in emissions for predicted ambient concentrations is summarized in Table 4. The new stack sampling data indicate that the greatest underestimations in emissions in the Phase II RI were for As, Zn, Pb-210 and Po-210. The highest overestimations in emissions were for fluorides. Table 4 lists the predicted factor increases and decreases in ambient concentrations for the discrete off-site receptors used in the risk assessment.

Overall, concentrations of As, Zn and Pb-210 would increase from a factor of less than 2 to about four times the predicted concentrations presented in the Phase II RI modelling results. The maximum estimated increase in Po-210 concentrations would be about 30%.

Decreases in predicted ambient concentrations of fluoride would range from about 20% to about one-third of previously reported concentrations. The largest decreases in predicted concentrations would be south of the facility.

Based on the new stack sampling data, all of the sources at the facility are now well characterized for trace constituent emissions. Numerically, the predicted ambient concentrations presented in the Phase II RI report may be under or over-estimated by up to a factor four at some receptor sites, and much less at most locations.

Table 1: Comparison of Trace Constituent Emission Rates Used in the Phase II RI Dispersion Modelling with New Stack Testing Data

		Annual Av	verage Emissio	n Rates (tonn	es/yr or Ci/yr)				
	Kiln Cooler Spray Tower					Taphole Fume Collectors (3)			
Trace Constituents	Phase II RI 1990/91	New Data	Phase II RI 1990/91	New Data	Phase II RI 1990	Phase II RI 1991	New Data ¹		
As Be Cd Mn Ag V Zn Mo	0.0001 0.0001 0.0002 0.0017 0.0001 0.0311 0.0161 0.0008	0.0314 ND 0.0145 0.0018 0.0047 NM 2.0122 NM	0.0005 0.0004 0.0006 0.0073 0.0006 0.1328 0.0688 0.0035	ND ND 0.0020 ND NM 2.24 NM	0.0001 0.0001 0.0030 0.0052 0.0001 0.0109 0.9534 0.0001	0.0001 0.0001 0.0040 0.0070 0.0002 0.0146 1.2855 0.0001	0.0023 ND 0.0004 0.0100 0.0046 NM 0.8340 NM		
Pb-210 Po-210 Ra-226 Th-230 U-234 U-238	0.99 0.0001 0.0001 0.0010 0.0012 0.0010 0.0010	0.0365 0.0804 0.0012 0.0007 0.0014 0.0017	0.0005 0.0005 0.0042 0.0053 0.0041 0.0043	0.0227 0.0007 0.0038 0.0004 0.0006 0.0007	0.0062 0.0037 0.0004 0.0004 0.0003 0.0004	0.0083 0.0050 0.0006 0.0005 0.0004 0.0005	0.0165 0.0028 0.0007 0.0008 0.0005 0.0007		

Notes:

ND - Not Detected NM - Not Measured

¹ Trace metals and fluoride based on sampling for THFC's #7, #8, & #9; radionuclides based on sampling for THFC #7 (x 3 to get annual emission rate for all three furnaces)

Table 2: Comparison of Trace Constituent Emission Rates in the Phase II RI Dispersion Modelling with Estimates Based on New Stack Testing Data

	Annual Avera	ge Emission Rates (to	onnes/yr or Ci/yr)	
	Furnace Build	ling Fugitives	Hot Slag	Disposal
Trace Constituents	Phase II RI 1990	New Data ¹	Phase II RI 1990/91	New Data ¹
As	2.22E-5	7.36E-4	3.81E-4	2.44E-2
Be	2.08E-5	ND	2.63E-3	ND
Cd	9.09E-4	1.23E-4	4.86E-3	4.12E-3
Mn	1.60E-3	3.19E-3	2.01E-2	1.06E-1
Ag	4.33E-5	1.47E-3	4.56E-4	4.89E-2
V	3.33E-3	NM	1.00E-1	NM
Zn	2.91E-1	2.68E-1	3.52E-3	8.88
Mo	1.87E-5	NM	4.69E-4	NM
F	1.7	0.06	31.0	2.1
Pb-210	0.0019	0.0044	0.0010	0.1470
Po-210	0.0011	0.0007	0.0009	0.0250
Ra-226	0.0001	0.0002	0.0106	0.0059
Th-230	0.0001	0.0002	0.0103	0.0071
U-234	0.0001	0.0001	0.0088	0.0048
U-238	0.0001	0.0002	0.0092	0.0061

#### Notes:

ND - Not Detected

NM - Not Measured

¹ Trace constituents based on emission rates measured during furnace tapping operations at taphole fume collectors.

Table 4: Effect of New Stack Emission Data on Predicted Ambient Concentrations at Discrete Receptor Sites

		Factor Decrease			
Discrete Receptor Sites	As	Zn	Pb-210	Po-210	· F
#1	1.72	1.88	1.96	1.07	1.74
#2	2.86	3.63	3.55	1.22	2.59
#6	3.63	3.90	2.54	1.14	2.21
#10	1.68	3.98	3.81	1.17	2.88
#12	2.91	3.91	4.27	1.31	2.80
#16	3.44	3.12	3.39	1.17	2.73
#36	1.36	1.39	1.18	1.02	1.20

Table 3: Comparison of Trace Constituent Emission Rates in the Phase II RI Dispersion Modelling with Estimates Based on New Stack Testing Data

Annual Ave	rage Emission Rates (tor	nnes/yr or Ci/yr)				
	Kiln Venturi Scrubbers					
Trace Constituents	Phase II RI 1990/91	New Data				
As	0.0578	NM				
Ве	0.0051	NM				
Cd	0.9985	NM				
Mn	0.7318	NM				
Ag	0.0092	NM				
v	0.0356	NM				
Zn	2.0084	NM				
Мо	0.0392	NM				
F	2.7	NM				
Pb-210	0.0604	0.0942				
Po-210	0.2487	0.2193				
Ra-226	0.0007	0.0012				
Th-230	0.0005	0.0006				
U-234	0.0011	0.0010				
U-238	0.0007	0.0013				

Notes:

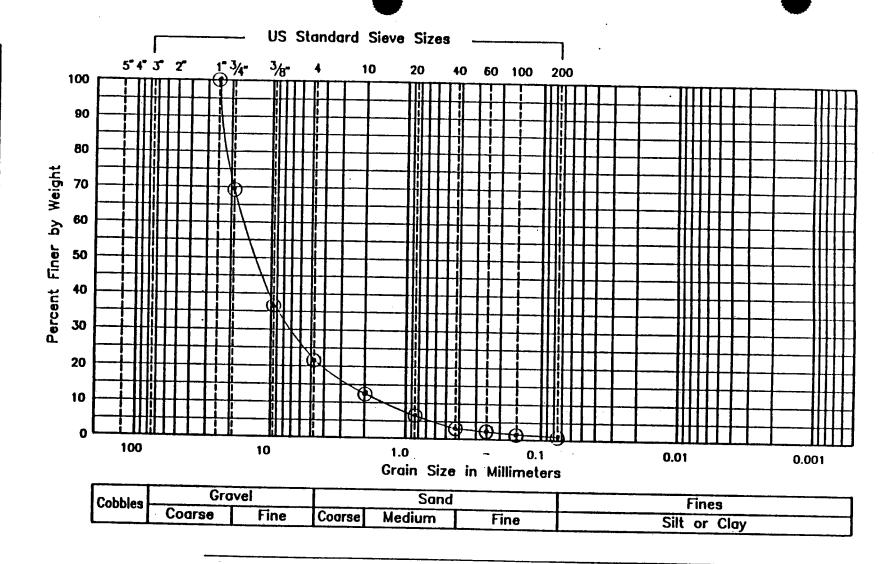
NM - Not Measured

s:\913-1101.608\1115mc1.doc

# APPENDIX F SEDIMENT PHYSICAL PROPERTIES

# APPENDIX F-1 PHASE I SAMPLES

GRAIN SIZE DISTRIBUTION 0 Golder Associates



Boring No.	Elev. or Depth	Wn	WL	Wp	l _p	Description
Soda-N	·	22.2				Olive gray (5 × 3/z), c-f GRAVEL some c-f sand, trace silt, (GW).

US Standard Sieve Sizes 5 4 5 2 40 60 100 200 100 90 80 by Weight Percent Finer 50 GRAIN SIZE 20 DISTRIBUTION 10 100 10 1.0 0.1 0.01 Grain Size in Millimeters Gravel Sand Fines Cobbles Coarse Fine Coarse Medium Fine Silt or Clay Golder Boring No. Elev. or Depth WL W_p l_P Description Brownish black (5 y 2/1), c-f GRAVEL, some c-f sand, trace silt, organic material present, (GW). 40.9 Soda-5 **Associates** 

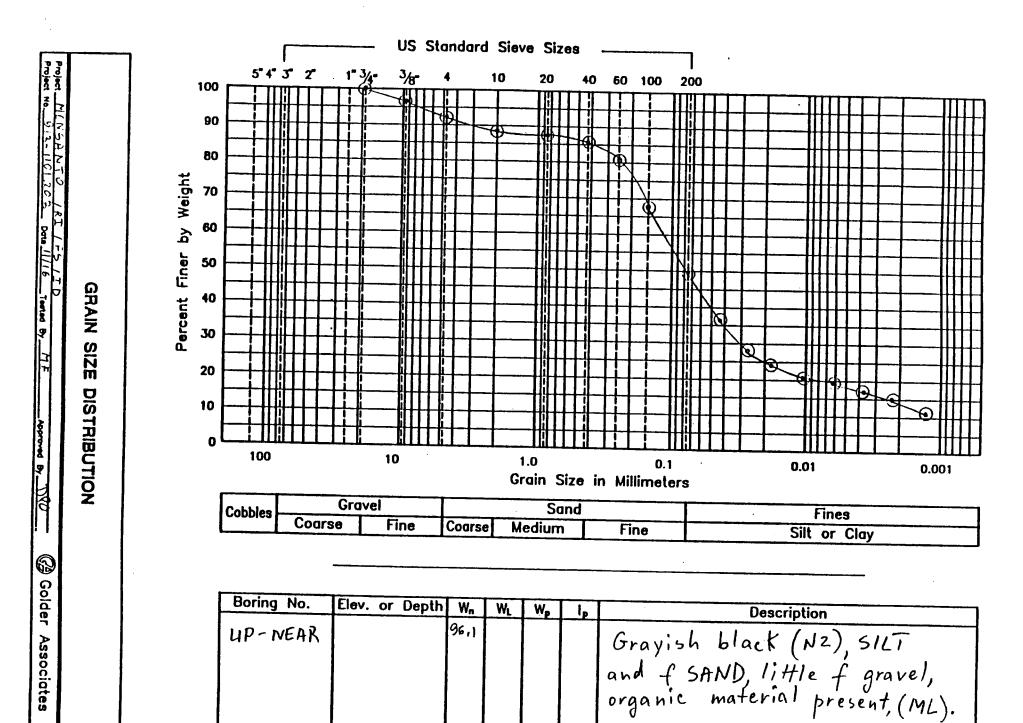
0.001

US Standard Sieve Sizes 5"4" 3" 2" 3/8-10 20 40 60 100 200 100 90 80 Percent Finer by Weight 70 60 50 GRAIN SIZE 40 **30** 20 DISTRIBUTION 10 100 10 1.0 0.1 Grain Size in Millimeters Golder Associates

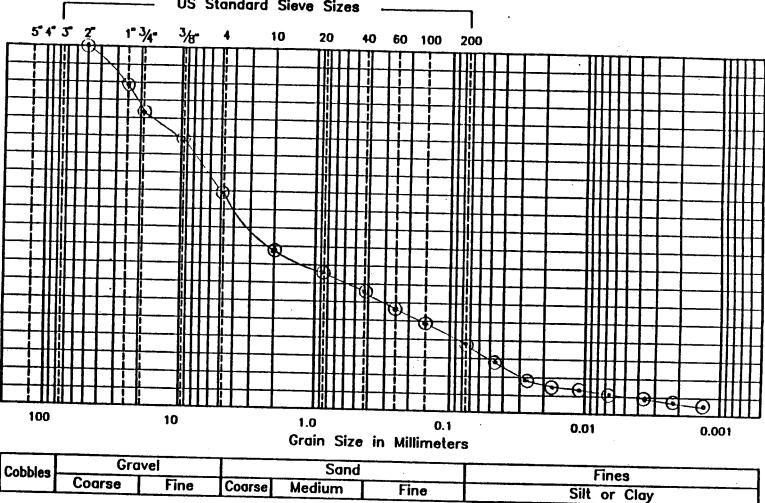
(e) 0.01 0.001

Cobbles		ivel		Sand		Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	Wn	WL	W _p	l _p	Description
OUTFLOW		528,1		,		Dark yellowish brown (10484/2), organic CLAYEY SILT, little c-f sand, (OL).



US Standard Sieve Sizes 543 2 10 20 40 60 100 200 100 90 80 by Weight 70 50 Percent Finer 50 GRAIN 40 **30** SIZE 20 DISTRIBUTION 10 100 10 1.0 0.1 Grain Size in Millimeters Gravel Sand Cobbles Coarse Fine Coarse Medium Fine Golder Associates



Boring No.	Elev. or Depth	Wn	WL	W _p	l _P	Description
UP-MI ODLE		62,9				Greenish black (56441), c-f GRAVEL and c-f SAND, some silt, organic material present, (GM).

<u>©</u> 0.001 Fines

Boring No.	Elev. or Depth	Wn	WL	Wp	I _P	Description
UP-FAR		142,7				Grayish black (N2), m-f SAND and SILT, organic material present, (SM).

### OLDER ASSOCIATES INC., REDMOND, WAD DISTURE CONTENT CALCULATION SHEET ASTM D-2216

PROJECT:

MONSANTO/RI/FS/ID 913-1101.203

PROJ. NO:

DATE:

11/19/91

BA

TECH: REVIEW:

DPU

BORING NO.	WET WT. (g)	DRY WT. (g)	TARE WT.	TARE NO.	MOISTURE (%)
SODA-N	300.82	258.72	69.01	5	22.2
SODA-S	404.71	318.19	106.75	X	40.9
OUTFLOW	273.69	123.39	94.93	20	528.1
UP-NEAR	360.55	220.90	75.59	32	96.1
UP-MIDDLE	398.35	273.81	75.91	OH	62.9
UP-FAR	320.97	173.88	70.78	40A	142.7

### SAMPLE SODA- N

Pycnometer number	L0208	
Temperature at weighings ( ^O C)	66.2% 19.0°C	
Weight flask + soil + water (Wb)	680.87	
Weight flask + water (Wa)	658.97	
(Wa - Wb)	-21.90	
Evaporating dish number	18	
Weight dish + dry soil	141.81	
Weight dish	107.39	
Weight dry soil (W ₀ )	34.42	
Temperature factor (K)	1.0002	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} \cdot W_{b})} \cdot K = 2.75$$

Comments:

## Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project MONSANTO / R I / FS / ID Project No. 9/3-1/01-203 Date ////5/9/ Tested By ISA Approved By IRO



SAMPLE SODA-S

Pycnometer number	10208	
Temperature at weighings ( ^O C)	66.47 19.1°C	
Weight flask + soil + water (W _b )	681.69	
Weight flask + water (Wa)	658.96	
(Wa - Wb)	-22.73	
Evaporating dish_number	6B	
Weight dish + dry soil	133.65	
Weight dish	96.91	
Weight dry soil (W ₀ )	36.74	
Temperature factor (K)	1.0002	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \cdot K = \frac{2.62}{}$$

Comments:

## Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project MONSANTO / RI/FS / ID |
Project No. 9/3-1/0/-203 | Date 1/15/9| Tested By SA Approved By DRO @



#### SAMPLE OUT-FLOW

Pycnometer number	L0208	
Temperature at weighings ( ^O C)	67.2°F 19.6°C	
Weight flask + soil + water (W _b )	679.61	
Weight flask + water (Wa)	658.91	
(Wa - Wb)	-20.7	
Evaporating dish number	K	
Weight dish + dry soil	130.83	
Weight dish	9521	
Weight dry soil (Wo)	35.62	
Temperature factor (K)	1.0001	

GS/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} \cdot W_{b})} \cdot K \qquad \underbrace{2 \cdot 39}$$

Comments:

## Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project MONSHN (0 / K L / F S / 1 ) / 5 / 9/ Tested By BH Approved By DPD



SAMPLE UP-NEAR

Pycnometer number	10208	
Temperature at weighings ( ^O C)	68.89 20.4°C	
Weight flask + soil + water (W _b )	701.58	
Weight flask + water (Wa)	658.82	
(Wa - Wb)	-42.76	
Evaporating dish number	20	
Weight dish + dry soil	170.39	
Weight dish	101.74	
Weight dry soil (W ₀ )	68.65	
Temperature factor (K)	1.0000	

GS/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{0})} \cdot K = \frac{2.65}{}$$

Comments:

## Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Tropic MONSANTO / FL/FS / 7D
Tropic No. 9/2-1/6/- 203 Date 11//5/9/ Tested By 3A Approved By 980



#### SAMPLE 11P-MIDTLE

Pycnometer number	L0208	
Temperature at weighings ( ^O C)	6644 19.1	
Weight flask + soil + water (W _b )	700.02	
Weight flask + water (Wa)	658.96	
(Wa - Wb)	-41.06	
Evaporating dish_number	7	
Weight dish + dry soil	172.91	
Weight dish	108.05	
Weight dry soil (W ₀ )	64.86	
Temperature factor (K)	1.0002	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{0})} \cdot K = \frac{2.72}{}$$

Comments:

#### **Figure** SPECIFIC GRAVITY DETERMINATION, ASTM D854



### SAMPLE UP- FAR

Pycnometer number	L0708
Temperature at weighings (OC) 687°F	20.4%
Weight flask + soil + water (W _b )	700.28
Weight flask + water (Wa)	658.83
(Wa - Wb)	-41.45
Evaporating dish number	25
Weight dish + dry soll	173.92
Weight dish	105.79
Weight dry soil (W ₀ )	68.13
Temperature factor (K)	1.0000

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_2 - W_0)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \cdot K = 2.55$$

Comments:

### Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

JLDER ASSOCIATES INC., REDNORD, WA

	•			
ASTE D-1140/C-136				
SIEVE ANALYSIS				
PROJECT	MONSANTO/RI	/FS/ID		
PROJECT NUMBER	913-1101.20	3		
ENGINEER	BAHTON			
DATE	11/18/91			
TECHNICIAN	RR-RE			
REVIEWER	<u> </u>	_		
:::::::::::::::::::::::::::::::::::::::		:::::::::::::::::::::::::::::::::::::::	:::::::::::::::::::::::::::::::::::::::	:::::::::
BOREHOLE HUMBER	1	<b>1</b>		*
SAMPLE HUMBER	* SODA-S	*	SODA-N	*
DEPTH (ft)	1	1		*
***************************************	:::::::::::::::::::::::::::::::::::::::	::::::::::::::::::::::::::::::::::::::	:::::::::::::::::::::::::::::::::::::::	:::::::::
TARE HUMBER	\$ ¥	1	I	<b>t</b> ,
TARE WT (g)	<b>100.43</b>	1	106.73	1
WET HT + TARE (g)		1		1
DRY HT + TARE (g)	<b>395.28</b>	1	486.84	t
	1	1		1
******************	::::::::::::::::::::::::::::::::::::::	*************	:::::::::::::::::::::::::::::::::::::::	::::::::
	* COMULATIVE		CONOLATIVE	
	* WEIGHT (g)	FIRER *	WEIGHT (g)	FINER *
TARE (g)			106.74	
•	<b>*</b> 100.37		106.74	
•	* 100.37		•	
•	<b>100.37</b>			
-, -	<b>*</b> 173.78	75.132 3/4"	222.17	
•, •	261.91	45.23# 3/8"	349.97	
• •	* 307.20	29.93* #4	407.02	
	338.36		440.50	
• • •	* 361.86		462.32	
	* 376.40	6.4% \$40	474.59	
***	* 382.61			
	386.67	2.9% #100		0.9%*
#200	<b>*</b> 389.74	1.93* \$200	485.79	0.3%
MEEMS TOMA GIRLID	•	•		•
MEETS ASTH SAMPLE		*	No.	
SIZE REQUIREMENT?	* RO	*	NO	
ntn	• 6.5	4 h4s	4 /	•
D10	1 0.8	* D10	1.6	*
D30	<b>3</b> 5	* D30	7.1	1
D60	<b>1</b> 6	* D60	17	<b>t</b>
Cu	20.0	* Cu	10.6	1
Cz	<b>2</b> .0	* Cz	1.9	1

SIZE OF LARGEST	RINIRON RYSS OL
PARTICLE	SAMPLE REQUIRED
#10	200g
\$4	500g
3/4"	1500g
1*	2000g
2-	4000g
3.	5000g
•	

******	111 <b>11</b> 1111	! <b>! ! ! ! !</b> !	11111111	11111	******	<b></b>				*******	<b>*******</b>	********	*******		********	********
*WORLSE!	EET FOR HO ASTH D-22	DISTORE	CONTENT	OF S	OILS	*******	•••••	*PART A: Y						*PART D: COA		
									•		1			1		
	ERT FOR SI							TARE 1:						STARE S:	32	
	ASTM D-42 BET FOR DR					.UKE CHAR	.GK)	STARR (g):	1-1.	75.59 320.66	TARE (g):	: . (a):	74.99 66.60	FIARE (g):	75.55	
	ASTH D-42		TERITOR :	01 301	179			TUALE DEA	(g): ¥9 (e):	308.33 720 90	*UABB DSA *PATOT MI'	. (g): 49 (#)•	07.03 61.39	) *BOIST WT. ( } *OVEN DRY WT		
	UPDATED 3		BY D. C	JSTEE				thi:	. (g): WI (g):	96.10	TINT:	#1 (2)·	11.81		1 (g): 31.43 8.27	
						/ <b>222222</b> 7	/########	********	/ <b>****</b>	*********	*****	********	*******	**********		*******
	:SEPARATIO								SIEVE OF COAR		H: SAMPLE:	OP-REAR		********		·
*WEIGHT	TOTAL SAN	IPLE + 1	fare, al'	R DRY	(g):	266.07			COMPLATIVE	PERCERT	1	FIRAL RESU		* SIZE OF		EASS OF
*WBIGHT	TOTAL SAM: OF AIR DR' OF -\$10 T	T TARR	(g):			90.04		*	WEIGHT (g)	FIRER	<b>*</b> \$12 <b>8</b>	PERCENT FI	NER	* LARGEST	+#10 PO	
															BEQUIRE	D
*WEIGHT	OF -\$10 F	RACTION	I + TARK	(g):	١.			*TARE (g)	75.57		<b>3</b>	100.01		*	******	
∓acica4 ±¥P1001	OF -\$10 F	SDICAUR KVC1102	יע פום ,י. פת פונ	XI (B)	j: •	101.40		<b>3</b> 3.	15.57 75.57	100.01 100.01	3: 2" 3: 1"	100.01	-	* 3°	5000g	
ENVER DE	OF +#10 FI RY WEIGHT	OF FIRE	ES (g):	1 (5/-	•	135 4F		* 1°	75.57		25 3/4.	100.04 100.0%		2° 1°	4000g 2000g	
*OVER DE	RY WEIGHT	OF COAT	ASE FRAC	TION	(e):	22.69		3/4	75.57	100.02		96.51		* 3/4 ⁻	1000g	
	RY WEIGHT (					158.15		* 3/8"	81.07	96.54		92.13		* 3/8	500g	
******	********	******	*******	*****	*****	*******			88.05		X* \$10	88.83		*		
	HYDROBET	er test	/ OR FIRM	E LBYC	17108			<b>\$</b> \$10	93.25	88.83		87.2%			REQUIREMENT?	
******								* PAB	96.27			85.31			**********	******
	RTER TIPE:				152B			1			* \$60	80.43		*		
KOHA	TIER HUEBE!	K:			-1515 6B				11111111111111111111111111111111111111			57.23 10.79			R/A	
					4			*LTKI G: 21	SIEVE OF FIRE		* \$200 * 0.0452				R/A R/A	
*SPECIFI	HOMBER: IC Gravity: H Tested:	l <u>•</u>			2.65			-	COMULATIVE						r/a R/a	
PORTION	TESTED:	•			-\$10				WEIGHT		* 0.0171				8/A	
*HOIST W	T. OF SOII	L (g):		ţ.	59.92									1	0 / a	
	ED DET NT	(#):		5	53 59			STARE (g)	70.76		* 0.0064	19.2%		******	**********	*******
\$ Rg :					1.00			# \$20	71.72	98.21		16.8%		* H	OTES:	
	D SOLUTION	Į.						* \$40			* 0.0023			<u> </u>		
	REECTION							* \$60	75.82	90.61		10.7%		*	<del></del>	
* TEMP.	PRAD							# #100 # #200	83.83 94.39	75.6%				<u>:</u>		
* 19.10								7277		55.9 <b>1</b>		*********	*********	<u>.                                  </u>	********	
* 25.70					APSED			ZERO	CORR.	CORR.	********		OBSTART	} <b>*****</b> ******	***********	*******
1						TEMP.	BYDRO	CORR.	FACTOR	PACTOR	2 FIBER		(TåGs)	DIAM.	LOG	TTOTAL
*D	er k	S			min.)			(CONTROL)		1	* ******	L, ca	I.	(ne)	DIAH.	SAMPLE
•											,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		,			**********
<b>20</b>	9	5		111		20.0										
20 20	9	6 8	0 1111						0.40							35.0:
¥ 20	9	13	0 ::::		3.00 8.00	22.6 22.4	20.0 18.0	3.67 3.75		1.00 1.00	31.21 27.31		0.01332 0.01332	0.0276	-1.56 -1.77	27.7:
¥ 20	ğ	25		222 2		22.3	16.0	3.79		1.00	27.32		0.01332	0.0171 0.0109	-1.77 -1.96	24.3! 20.9:
20	10	5		111 6		22.3	15.0	3.79		1.00	21.77		0.01332	0.0164	-2.20	19.2:
1 20	11	55		*** 17		22.4	13.5	3.75		1.00	18.93		0.01332	0.0038	-2.42	16.8:
<b>2</b> 0	16	44		222 45		22.2	12.5	3.83		1.00	16.92		0.01332	0.0023	-2.63	15.01
* 21	8	43	8 1227	***141	8.00	19.7	11.5	4.77		1.00	12.02		0.01382	0.0014	-2.86	10.7:
1																
						********	*******	**********	/************/	********	**********	! <b>*****</b>				*******
PROJECT	: PUNBER:		DRSARTO/P 13-1101	/1/15/	ID (			91C7.	203	3105.	** /5* /61			GOLDER ASSOCI		
ENIC			FF.					TASE: REVIEWED B	203 RY:	DATE	11/21/91			GEOTECHNICAL REDMOND, WASH	IBSTING LABO. Pincpan	KATUKI
				*****		*******	*******	u wamatida '888888888	,,, 		**********	- !::::::::::::::	*******	11111111111111 1111111111111	11 VA 1 AB	*******

*WORESHEET FOR SIETE AND NTDROMETER  * ASTR D-422 (MODIFIED FOR TEMPERATURE CHANGE)					*TARE #: *TARE (g): *HOIST HT.		# 20 #TARE 8: 94.93 #TARE (g): 273.69 #MOIST NT. (g):			25.0	* B *TARE \$: 5 *TARE (g): B *HOIST NT. (g	12 77.99 1: 82.18	)		
	ASTH D-42 UPDATED 3	1 /20/90 1	BY D. OSTI	BR .			*OVER DRY	WT (g):	123.39 528.11%	*OVER DRY *NI:	RT (g):	34.86 86.9	D *OVEN DRY WT 71*W1:	(g): 80.20 89.59	1
	SEPARATIO			*******	******	********	*PART E: S		SE FRACTION	* SAMPLE:	ODTFLOW		***********		
RIGHT (	OF AIR DR'	Y TARE (		DRT (g):	90.09		t t	WEIGHT (g)	PERCERT FIRER	* *SIZE	FINAL RESUL PERCENT FIN	TS Er	SIZE OF LARGEST	HINIBOS +#10 PO	MASS OF
EIGET		RACTION	+ TARE (				TARE (g)	73.70		<b>3</b> .	100.0%	•••••	PARTICLE	BEQUIRE	
			AIR DRY AIR DRY (		105.66 8.20		2°	73.70 73.70	100.0% 100.0%	-	100.0%		1 3°	5000g	
VEN DR	NEIGET (	DE FIRES	5 (g):	(8).	56.51		1.	73.70	100.03	-	100.0% 100.0%		* 2° * 1°	4000g 2000g	
AER DE.	r neiget (	OF COARS	E FRACTIO		4.33		1 3/4"	73.70	100.0%	- , -	100.0%		¥ 3/4"	1000g	
			SABPLE (				± 3/8°	73.70	100.03		100.0%		£ 3/8°	500g	
			ERRETERS.		*******	********	12 \$4 1 \$10	73.70 74.61	100.03 98.53		98.5% 90.9%		**************************************	ART DEMPRO	VPC
nwa t.	BIDDADDDI	DU 1991	AB LIDS E	TAULIUB			* PAB	75.08	97.73		90.91		*MEETS ASTM RE		
	ER TYPE:			152H			1			<b># #60</b>	88.91				
	ER ROEBEI	R:		15-1515					********		87.4%		* D10: N/		
YSI BI	IOMBER: Indep			7			*PART G: SI	IEAE ON KINE	FRACTION	# #200 # 0.0436	85.0%		* D30: B/	- · · · · · · · · · · · · · · · · · · ·	
	GRAVITY:	:		3.29				COMULATIVE	PERCENT		75.0% 59.8%		* D60: N/		
	TESTED:			-\$10				WEIGHT		0.0166	49.6%		* Cz: N/		
	. OF SOII			63.32							48.3%				
B: Orkreii	D DRY WY	(g):		33.87 1.00			*TABE (g) * #20	95.19	09.70		39.42		***********		******
_	SOLUTION	ì		1.00			* \$40	97.79 98.11	92.334 91.434		33.31 25.61		* ROT	12:	
	RECTION	•					¥ \$60	98.50	90.231		17.6%				
							<b>\$100</b>	99.00	88.7%	3					
TEMP. 19.10							<b>\$ \$200</b>	99.82	85.31				*		
25.70				BLAPSED			ZERO	CORR.	CORR.			RSTART	***********	*********	******
				TIME	TEBP.	HYDRO	CORR.	PACTOR	PACTOR	I FIBER		(TåGs)	DIAM.	LOG	TOTAL
_	R B	S		(min.)	(C)	BEADIRG	(COMIBOL)	t	ā		L,ca	I	(82)	DIAH.	SAMPL
20	9	16	0 22222								~~~~~				
20	9	17	0 ::::::	1.00	22.2	33.0	3.83	0.40	9.87	76.21		0.01332	0.0436	-1.36	75
20	9	19	0 ******		22.2	27.0	3.83	0.40	0.87	60.73	11.703	0.01332	0.0263	-1.58	59
20 20	à	24 36	0 *****		22.1 22.1	23.0 22.5	3.86 3.86	0.40	0.87	50.33		0.01332		-1.78	49
20	) j	16	0 111111		22.1	19.0	3.86	0.40 0.40	0.87 0.87	49.0X 40.0X		0.01332 0.01332		-1.98 -2.21	48 39
	11	56	0 *****		22.3	16.5	3.79	0.40	0.87	33.81		0.01332		-2.41	33
20	16	45	0 *****		22.2	13.5	3.83	0.40	0.87	25.91	13.917	0.01332	0.0023	-2.63	25
20	٥	44	0 ::::::	1408.00	19.7	12.0	4.77	-0.30	0.87	17.83	14.163	0.01382	0.0014	-2.86	17
	8								•••••	•••••	****				
20 21		******	******	******	******	********	*********				*********	IXXXXXXX		EXELECTE:	
20 21 ****** ""JECT:	*******	HON	******** SARTO/PI/		*******	*******		**********	•••••	•••••	********	******	GOLDER ASSOCIAT		
20 21 ****** ""JECT:	******** Houber:	HON	SARTO/PI/ -1101		*******	********	TASI: BBVIEWED B	203	DITE: DDO	11/22/91	**********	******		PRS INC. Esting labo	-

*NORISEEET					*******		*PART A: #A	TURAL HOIST	URE CONTENT	PART C: F	HE FRACTION	OISTURE	*PART D: COARS	E FRACTION	BOISTORE
	TE D-221						*					96	\$	. •	
" " The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of t						*TARE #:			FTARE (g):			35 *TARE 8: 3 5.16 *TARE (g): 73.73			
					*TARE (g): *HOIST WI.	(a)·		HOIST WY.			*BOIST WT. (g)				
	TH D-421		PITAN AL	20182			*OVER DRY W		173.88	OVER DRY I	îî (g):		OVER DRY WY (		
2 IP	DATED 3/	20/90 B	T D. OSTE	B			##1:		142.67%	##1 :		9.31	14 <b>7</b> 1:	7.443	
*******	11111111	******	*******	******	******							******	***********	*********	********
*PART B:5E	PARATION	OF FRA	CTIONS				1	EVE OF COAR			UP-FAR *********	******	**********	********	********
*WEIGHT TO				RY (g):	303.51			COMPLATIVE			FIRAL RESULT.		* SIZE OF		MASS OF
*MEIGHT OF		-	••		90.07			WIIGHT (g)			PERCENT FINE		* LARGEST	+#10 POI	
*WEIGHT OF				,	90.07					: 3°	100.0%	******	- PAKTICLE	REQUIRE	
SWEIGHT OF							*TARE (g)	73.70 73.70	100.01		100.01		: 3.	5000g	
*WEIGHT OF					205.41 8.03		* 2·	73.70	100.02	-	100.03		2.	4000g	
*OVER DRY				6).	187.92		1.	73.70	100.03		100.0%		<b>1</b>	2000g	
*OVER DRY				B (g):			± 3/4°	73.70	100.03	•	100.02		2 3/4°	1000g	
*OVER DRY					195.39		3/8°	73.70	100.0%	<b>34</b>	100.01		± 3/8°	500g	
*****					******	*******	14 #4	73.70	100.0%	<b>* \$10</b>	97.3%	,	<b>t</b>		
*PART F: H	YDROBETE	P TEST	OR FIRE F	RACTION			<b>\$</b> \$10	78.91	97.3%		75.1%		*HEETS ASTH RI	-	YES
2							* PAR	79.65	97.0%		59.4%		***********	********	********
*HYDRORETE				152H			*			<b>\$ \$ \$ \$ \$ \$ \$ \$ \$ \$</b>	52.3%		# 710. W.	14	
*HYDROHETE		l <b>:</b>		15-1515				**************************************			46.4% 40.9%		* D10: E/		
AP NO				18 3			* TARI 6: 51	EVE OR FIRE		• 0.0468	36.9%		* D60: E/		
SPECIFIC	BER: CDAVITY	•		2.55				CUMULATIVE			33.1%		* Cu: R	_	
*PORTION T				-\$10				WIIGHT		0.0171	27.43		* Cz: 1/		
*HOIST WT.		{g}:		57.73							21.73				
*CORRECTED				52.81			STARE (g)	78.49		0.0064	20.7%		**********		*******
\$ RB :				1.00			<b>*</b> \$20	90.54	77.23		18.9%		* B05	ES:	**
*STARDARD		i					* 840	99.06	61.12		15.2%		<u>:</u>		
*ZERO CORR							* #60	102.94	53.72 47.62		12.1%		<u>;</u>		
* TEMP. B							* \$100 * \$200	106.15 109.10	42.0%				;		
* 19.10									********	- *********	*********	******	**********	*******	*******
<b>25.70</b>				RLAPSED			IRRO	CORR.	CORR.			RSTART			
*				TIME	TEMP.	EYDRO	CORR.	FACTOR	FACTOR	I FIRER		( <b>18</b> 6s)	DIAM.	roe	TTOTAL
ad EB	ı	\$	•	(min.)	(C)	BEADING	(CORTROL)	t	8		L, ca	I	(22)	DIAH.	SAMPLE
<b>2</b> 20	8	54	0 *****	0.00											
<b>2</b> 20	8	55	0 ::::::		22.3	23.0	3.79	0.40	1.02	37.9		0.01332		-1.33	36.92
<b>20</b>	8	57	0 *****		22.3	21.0	3.79	0.40	1.02	34.0		0.01332		-1.56	33.12
<b>2</b> 0	9	2	0 222222		22.2	18.0	3.83	0.40	1.02	28.13		0.01332		-1.77	27.42
20	9	14	0 *****		22.1	15.0	3.86 3.90	0.40 0.40	1.02 1.02	22.35 21.25		0.01332		-1.95 -2.20	21.73 20.73
20 20	9 11	54 54	0 222222		22.8 22.2	14.5 13.5	3.83	0.40	1.02	19.5		0.01332		-2.43	18.92
± 20	15	43	0 *****		22.2	11.5	3.83	0.40	1.02	15.6		0.01332		-2.63	15.22
2 21	8	42	0 ======		19.7	11.5	4.77	-0.30	1.02	12.4		0.01382		-2.86	12.12
1	•														
	******				********	******	*********	**********	********	*******	*********	******	***********		********
*PROJECT:			SANTO/PI/	TS/ID				***					GOLDER ASSOCIA		DIBARE
*PROJECT I	RUMBER:		3-1101				TASI:	203	DATE: Seo	11/21/91			GEOTECHNICAL T		RATORY
PECENICIA	LK: ********	1	<b>!</b> }				REVIEWED 1	51: _	\ <b>\)</b> \(\)\(\)				REDBOND, WASE!	תטוטת	

***************************************				
*NORISHERT FOR HOISTORE CONTENT OF SOILS			FIRE PRACTION MOISTOR	E *PART D: COARSE FRACTION MOISTURE :
# ASTM D-2216	*	*		<b>.</b>
*WORESHEET FOR SIETE AND HYDROMETER  ASTH D-422 (MODIFIED FOR TEMPERATURE CHARGE)	STARE S:	OH #TARE #:		FTARE S: B 1
* ASTE D-422 (MODIFIED FOR TEMPERATURE CHARGE) **FORESHEET FOR DRY PREPARATION OF SOILS	*TARE (g):	75.91 *TARE (g):		*TARE (g): 107.27
* ASTH D-421	*HOIST WY. (g): *OVER DET WY (g):	398.35 *HOIST WI.		2 *MOIST WT. (g): 299.58 :
* OPDATED 3/20/90 BY D. OSTER	*NI:	273.81 *0VEH DRY 62.93X*XX:		5 *OVEN DET WI (g): 290.65
***************************************		52.304*#4: 1111111111111111	)6.8 *****************	)2=H2: 4.872 :
*PART B:SEPARATION OF FRACTIONS		ESE FRACTION: SAMPLE:	OP-HIDDLE	;
*WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 390.99	* COMULATIVE	PERCENT *	FIRAL RESULTS	* SIZE OF HIRINDH HASS OF :
*WEIGHT OF AIR DRY TARE (g): T6.34	* WEIGHT (g)		PERCENT FINER	* LARGEST +#10 PORTION :
*WEIGHT OF -\$10 TARE (g): 76.33	<b>!</b>			-* PARTICLE REQUIRED :
*WEIGHT OF -BID FRACTION + TARE (g): 197.83	*TARE (g) 107.30	: 3.	100.0%	1
*WEIGHT OF -PID FRACTION, AIR DRY (g): 121.50	<b>3</b> 107.30	100.03* 2*	100.0%	* 3° 5000g ÷
*WEIGHT OF 4810 FRACTOR, AIR DRY (g): 193.15	* 2 107.30	100.0%* 1	89.7%	* 2° 4000g 2
*OFER DET WEIGHT OF FIRES (g): 114.30 *OFER DET WEIGHT OF COARSE FRACTION (g): 184.18	* 1 137.96	89.7% 3/4	81.4%	* 1° 2000g 2
*OVER DET REISET OF TOTAL SAMPLE (g): 298.48	* 3/4" 162.88	81.47: 3/8"	74.3%	* 3/4" 1000g *
######################################	* 3/8" 183.96 ** 84 228.97	74.33: \$4	59.2%	* 3/8" 500g :
*PART F: BYDEOMETER TEST OF FIRE FRACTION	** \$4 228.97 * \$10 274.89	59.2% \$10	43.91	*
\$	PAR 287.26	43.9%* \$20 39.7%* \$40	38.1% 32.4%	*MEETS ASTH REQUIREMENT? NO :
*HYDROMETER TYPE: 152H	1	\$ \$60	28.31	1
*EYDRONETER HONDER: 15-1515	*************		24.4%	: D10: N/A
TR NUMBER: BLK	*PART G: SIEVE ON FINI	7477	19.0%	2 D30: B/A
△ NUMBER:	*	* 0.0474	14.6%	1 D60: R/A
*SPECIFIC GRAVITT: 2.72	* COMPLATIVE	PERCENT # 0.0286	9.3%	* Cu: H/A :
*FORTION TESTED: -#10	* WEIGHT	FIRER # 0.0178	7.0%	* Cz: H/A
*HOIS? WY. OF SOIL (g): 60.64	<b>‡</b>		7.0%	1 2
*CORRECTED DRY WY (g): 57.05	*TARE (g) 69.00	* 0.0066	5.5%	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
*Re: 1.00	± \$20 76.45	86.9%* 0.0037	4.6%	* ROTES: *
*STANDARD SOLUTION	<b>* 840</b> 83.91	73.93* 0.0023	3.8%	1
*ZERO CORRECTION	<b>\$ \$60 89.28</b>	64.52# 0.0014	2.61	1
***************************************	<b>* \$100 94.36</b>	55.5%		*
* TEMP. READ.	<b>\$200</b> 101.30	43,42*		11
* 19.10 5.00				*************************
* 25.70 2.50 ELAPSED	ZERO CORR.	CORR.	BFF. COESTART	
TINE TENT. MIDEV	CORR. PACTOR	FACTOR I FINER	DIPTH (T&Gs)	DIAH. LOS STOTAL, #
*D HR H S (min.) (C) READING	(CORTROL) t	8	L,ca I	(mm) DIAM. SAMPLE *
* 20 8 43 0 ****** 0.00		**************		*
* 20 8 44 0 ***** 1.00 21.9 23.0	3.94 0.20	0.99 33.31	12.359 0.01348	0.0474 -1.32 14.6%
2 20 B 46 0 ***** 3.00 21.9 16.0	3.94 0.20	0.99 21.21		0.0286 -1.54 9.35
2 2D 8 51 0 ***** 8.00 21.9 13.0	3.94 0.20	0.99 16.03		0.0178 -1.75 7.03:
* 2D 9 3 0 ***** 20.00 21.8 13.0	3.98 0.20	0.99 15.9%		0.0113 -1.95 7.022
2 20 9 43 0 ***** 60.00 21.8 11.0	3.98 0.20	0.99 12.5%		0.0066 -2.18 5.522
* 20 11 53 0 ***** 190.00 22.2 9.5	3.83 0.40	0.99 10.5%		0.0037 -2.43 4.6%
* 20 16 42 0 ****** 479.00 22.2 8.5	3.83 0.40	0.99 8.81		0.0023 -2.63 3.832
± 21 8 41 0 *****1438.00 19.7 8.5	4.77 -0.30	0.99 5.91		0.0014 -2.85 2.63*
1				•
ADDATES.	**************	***********		
*PROJECT: MONSARTO/PI/FS/ID	B140 A			GOLDER ASSOCIATES INC. *
*PROJECT RUMBER: 913-1101 ***CURICLAR: MF	TASI: 203	DATE: 11/21/91		GEOTECHRICAL TESTING LABORATORY :
	REVIEWED BY:	WU		REDBOND, WASEINGTON
***************************************	******************	**************	•••••	

# APPENDIX F-2 PHASE II SAMPLES

#### GOLDER ASSOCIATES INC., REDMOND, WA

#### SUMMARY OF MOISTURE CONTENT (ASTM D-2216) AND SPECIFIC GRAVITY (ASTM D-854)

PROJECT:

MONSANTO/RI/FS SEDIMENT/ID

PROJ. NO:

913-1101.603

DATE:

1-26-93

TECH:

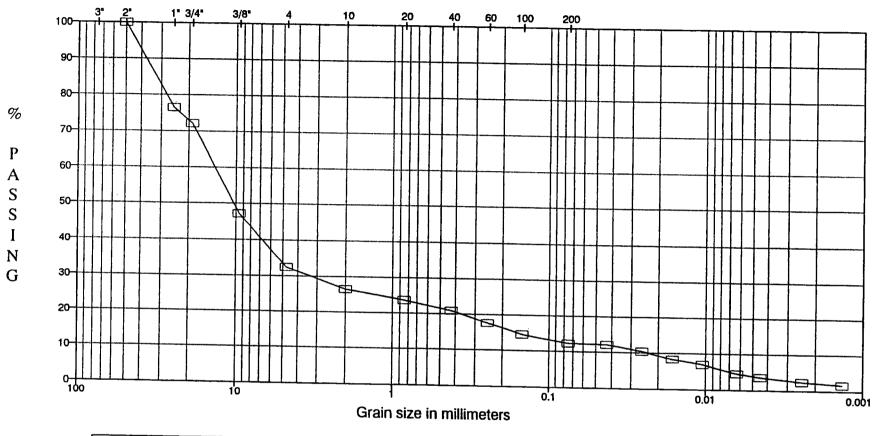
MF

REVIEW:

DPO

SAMPLE ID	DEPTH (in)	MOISTURE CONTENT (%)	SPECIFIC GRAVITY
SCSS-600	-	-	2.68
SCSS-900	-	- 1	2.65
SCSS-1200	-	-	3.02
SCSS-2400	-	-	2.56
MSSS-100	-	-	2.40

### PARTICLE SIZE DISTRIBUTION US STANDARD SIEVE OPENING SIZES



Coarse	Fine	С	Med	Fine	
GRA	VEL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
SCSS-600	:						Brownish black (5 YR 2/1), c-f GRAVEL, some c-f sand,
L							some clayey silt, (GM).

PROJECT:

MONASNTO/RI/FS SEDIMENT/ID

PROJECT NO.: 923-1101.603

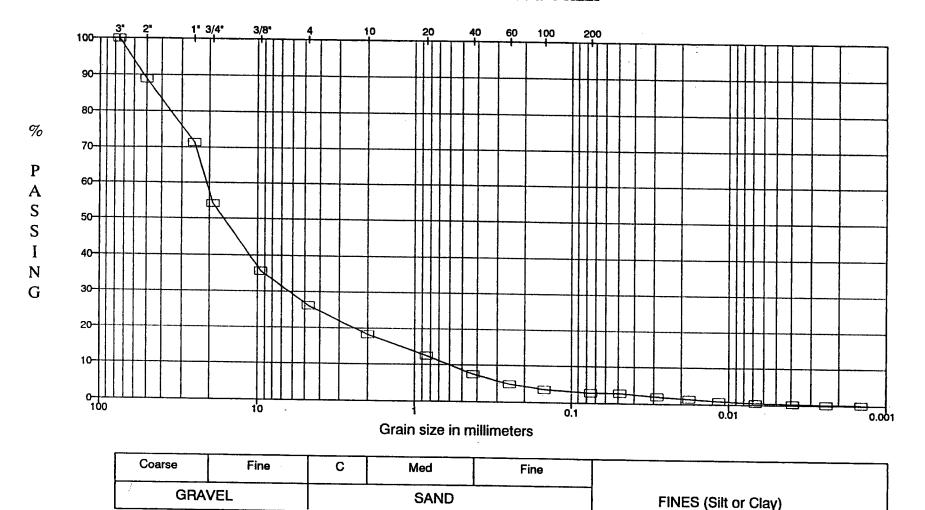
DATE: 1-10-93

TECH: MF

REVIEW: DPO

GOLDER ASSOCIATES INC.

REDMOND, WA



SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
SCSS-900						GP	Olive black (5 Y 2/1),
							c-f GRAVEL, some c-f sand,
<u> </u>							trace clayey silt, (GP).

PROJECT:

MONASNTO/RI/FS SEDIMENT/ID

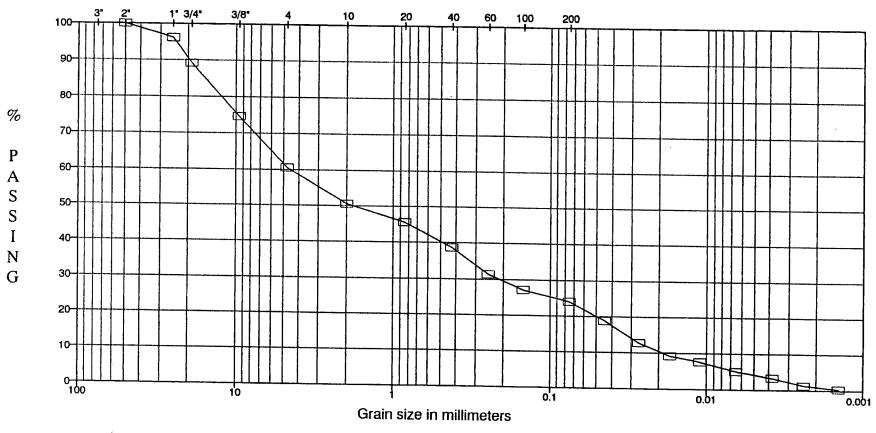
PROJECT NO.: 923-1101.603

DATE: 1-10-93

TECH: MF

**REVIEW: DPO** 

GOLDER ASSOCIATES INC. REDMOND, WA



Coarse	Fine	С	Med	Fine	
GRA'	VEL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
SCSS-1200							Olive black (5 Y 2/1), c-f GRAVEL and c-f SAND
			<u> </u> 				some clayey silt, (GM).

PROJECT:

MONASNTO/RI/FS SEDIMENT/ID

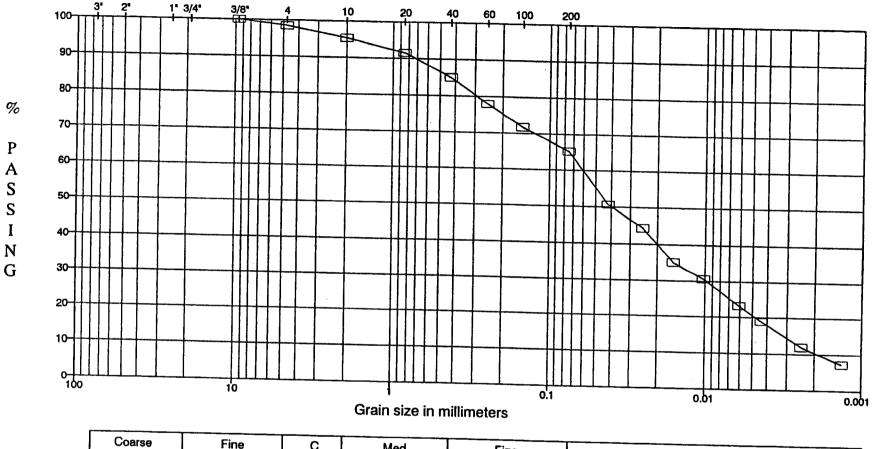
PROJECT NO.: 923-1101.603

DATE: 1-10-93

TECH: MF

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.



Coarse	Fine	С	Med	Fine	
GR	AVEL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	Wat	7.7	Dir.			
	DELIH	W%	LL	PL	PI	USCS	DESCRIPTION
SCSS-2400							Brownish black (5 YR 2/1), CLAYEY SILT and m-f SAND, trace f gravel, (ML).

PROJECT:

MONASNTO/RI/FS SEDIMENT/ID

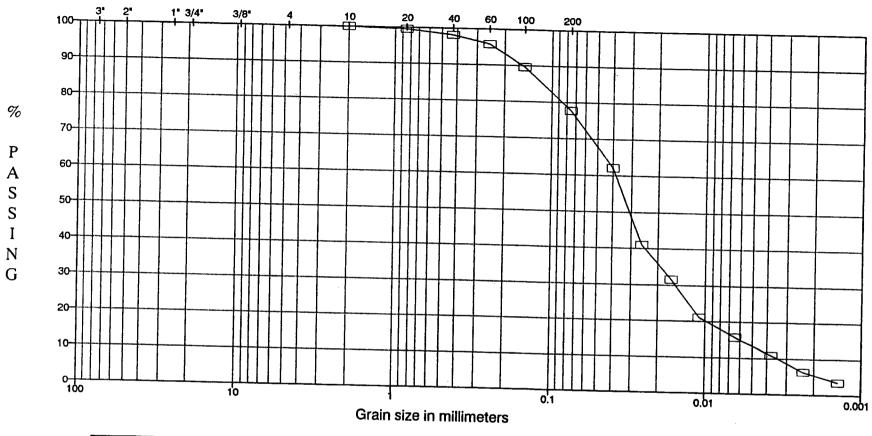
PROJECT NO.: 923-1101.603

DATE: 1-10-93

TECH: MF

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.



Coarse	Fine	С	Med	Fine	
GRA	VEL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
MSSS-100							Brownish black (5 YR 2/1),
							CLAYEY SILT, some f sand, (ML).

PROJECT:

MONASNTO/RI/FS SEDIMENT/ID

PROJECT NO.: 923-1101.603

DATE: 1-10-93

TECH: MF

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.

Iwana un cara		•						ı.						
WORKSHIELD FOR	KHYDROM	TUR AND SIL	(VE		PARTA:	NATURAL	Mensturii	T PARTE.	#10 844 \10					
AST	22 (MODIFII	D FOR TEMP	ERATUR	RE CHANGE	)			''''' '	-w to MO12	TORE	PARTI	): +#10 MO	ISTUR	L
MOKKSHE	R DRY PREP	ARATION OF	SOILS		TARE #:									
ASTM D-4:					TARE (g)		<del></del>	TARE #:		R	TARE #	<b>#:</b>	1	S-3
WORKSHEET FOR	R MOISTURE	E CONTENT O	F SOILS					TARE (g		107.09	TARE (	e):		90.10
ASTM D-22	216				MOIST W			MOIST V	VT. (g):	224.87	MOIST		ŀ	
	11/26/91 BY	D OSTED				RY WT (g):		OVEND	RY WT (g):	216.42	OVENT	WT.(g). DRY WT (g):	ļ	743.05
PART B: SEPARAT	FION OF ED	CEIONG			W%:			W%:	- (8)	7.7%		JKI WI (g):	ł	727.33
THE BUBLINGS	HON OF FRA	CHONS			PART E:	SIEVE OF	<b>#10</b>			1.176	W%:		<del></del>	2.5%
WEIGHTTOTAL					1			FINAL	RESULTS					
WEIGHT TOTAL S	AMPLE + T	ARE, AIR DRY	(g):	948.10		CUM	PERCENT	1	KESUL 13	1	BORING:			
WEIGHT OF AIR	ORY TARE (g	g):		107.12	1	WEIGHT	FINER	65		-	SAMPLE:	SCSS-600		
WEIGHT OF -#107	ΓARE (g):			107.12		LIGITI	LINER		PERCENT	1	DEPTH:			
WEIGHT OF #10 F	FRACTION +	TARE (g):		295.15	TARE (g)	20.00	٦	SIZE	FINER	1				•
WEIGHT OF -#10 F	FRACTION, A	AIR DRY (e)		188.03			-1	İ		1				
WEIGHT OF +#10	FRACTON.	AIR DRY (a):			3"	90.08		3"	100.0%	1 (	COLOR:			
OVEN DRY WEIGI	IT OF FINE	(a)		652.95	2"	90.08		2"	100.0%		Brownish black (	E VD 3/15		
OVEN DRY WEIGH	HTOECOAD	(E).	• • •	174.54	1"	280.66	76.5%	1"	76.5%	"	STOWNISH ORCK	J IR 2/1),		
OVEN DRY WEIGH	UT OF COAR	SE FRACTION	۷ (g):	637.23	3/4"	316.63	72.1%	3/4"	72.1%	,	\			
OVEN DRY WEIGH	HI OF TOTA	L SAMPLE (g):	<u></u>	811.77	3/8"	520.07	4	3/8"	47.0%		DESCRIPTION			
DARTE INCREA				-	#4	637.88		#4		l l'	-f GRAVEL, so	me c-f sand,		
PART F: HYDROM	IETER TEST	ON FINE FRA	CTION		#10	685.76		13	32.5%	<u>[s</u>	ome clayey silt,	(GM).		
						005.70	20.0%	#10	26.6%	1				<del></del>
HYDROMETER TY		152H			İ			#20	23.7%	İ	USCS:	GM		
HYDROMETER NU	JMBER:	15-1515			<del></del>			#40	21.0%	i				
BEAKER NUMBER	<b>:</b>	M			BARTO			#60	17.8%					
FLASK NUMBER:		8			PARIG:	SIEVE OF -	¥10	#100	14.7%	i	LL:			
SPECIFIC GRAVIT	Y:	2.68						#200	12.4%	ł	PL:	<b>}</b>		
PORTION TESTED:	•	-#10					PERCENT	0.0431	12.2%	I	PI:	<b> </b>		
MOIST WT. OF SOII				i		WEIGHT	FINER	0.0257	10.5%		1 1;	L		
CORRECTED DRY	~ (g). WT (a).	67.04						0.0163	8.4%					
Rm:	W I (g):	62.23			TARE (g)	77.90	i i	0.0106	6.9%	1	D			
		1			#20	84.62	89.2%	0.0063	4.5%	]	D10:	N/A		
					#40	91.05	78.9%	0.0045		l	D30:	N/A		
STANDADD COLL		TEMP.	READ.		#60	98.57	66.8%	0.0043	3.5%		D60:	N/A		
STANDARD SOLUT	ITON	27.0	6.0		#100	105.70	55.3%		2.4%	ŀ	Cu:	N/A		
ZERO CORRECTIO	N	19.4	8.0	i	#200	111.06	46.7%	0.0013	1.6%	İ	Cz:	N/A		
						111.00	40.7%			1				
		ELAPSED			ZERO	CORR.	CORR.		- 1313	<u> </u>				
		TIME	TEMP.	HYDRO	CORR.	FACTOR		~ ~ ~	EFF.	CONSTANT				
D HR M	<u>1S</u>	(min.)		READING	(CONT.)			% FINER	DEPTH	(T&Gs)	DIAM.		LOG 9	%TOTAL
					(CONT.)	t	a		L,cm	K	(mm)			SAMPLE
	45 0	0.0												. um LC
	46 0	1.0	21.4	36.0	~ -									
22 10	48 0	3.0	21.4		7.5	0.2	1.0	45.9%	10.227	0.01348	0.0431		1 27	12.2~
	53 0	8.0	21.5	32.0	7.5	0.2	1.0	39.5%	10.883	0.01348	0.0431		-1.37	12.2%
22 11	5 0	20.0		27.0	7.4	0.2	1.0	31.6%	11.703	0.01348			-1.59	10.5%
		<b></b>	21.6	23.5	7.4	0.2	1.0	26.0%	12.277	0.01348	0.0163		-1.79	8.4%
		60.0	22.0	17.5	7.3	0.4	1.0	16.9%	13.261		0.0106		-1.98	6.9%
	-	120.0	22.6	15.0	7.2	0.4	1.0	13.2%		0.01332	0.0063		-2.20	4.5%
	43 0	418.0	23.4	12.0	6.9	0.7	1.0	9.2%	13.671	0.01332	0.0045		-2.35	3.5%
ر ۱۱ ک	20 0	1475.0	20.5	11.5	7.7	0.0	1.0		14.163	0.01317	0.0024	•	-2.62	2.4%
<del></del>	<del></del>				,	0.0	1.0	6.1%	14.245	0.01365	0.0013		-2.87	1.6%
PROJECT		·												
PROJECT:	MONASN	TO/RI/FS SED	IMENT/II	D										
PROJECT NUMBER:	923-1101.6	03			DATE:		10.02			G	OLDER ASSOC	CLATES INC.		
TECHNICIAN:	MF_				REVIEWE		l-10-93			GI	EOTECHNICA	L TESTING	AROD	ATOPV
					VEALENE	ואטו:	DPO			RI	EDMOND, WA	SHINGTON	-ADUK	WIOKI
												I OI4		1

1 A31M D-422 (N	DROMETER AND SIEVE MODIFIED FOR TEMPERATURY	RE CHANGE	PARTA	: NATURAL	MOISTURE	PART	C: -#10 MOI	STURE	BARR		
	Y PREPARATION OF SOILS	CALANGE)				_1		LONE	PART	ΓD: +#10 MOIST	URE
1 V2 1 M D-47 I			TARE #	:		] TARE		100		<b>-</b>	
WORKSHEET FOR MC	ISTURE CONTENT OF SOILS		TARE (g	):		TARE (		77.85	TARE		В
U2 T M D-2210			MOIST	VT. (g):		MOIST	WT. (g):				
UPDATED 11/2	6/91 BY D. OSTER		OVEND	RY WT (g):		OVEN	DRY WT (g):	185.61	MOIS	T WT. (g):	1112.3
PART B: SEPARATION	OF FRACTIONS		W%:			W%:	DICT W1 (g):		OVEN	DRY WT (g):	1071.1
Į.			PARTE:	SIEVE OF	#10	T		7.8%	W%:		4.5%
WEIGHT TOTAL SAMP	LE + TARE, AIR DRY (g):					FINA	L RESULTS				
LUSION OF AIR DRY	ARE (a).	1250.40		CUM	PERCENT	1 11110	T KE20L12	1 -	BORING:		
WEIGHT OF -#10 TARE	(a):	107.14		WEIGHT	FINER	11		S	SAMPLE:	SCSS-900	→
WEIGHT OF -#10 FRAC	TION LTARE (	107.14			* 111211	UKAIN	PERCENT	[ ]	DEPTH:		
WEIGHT OF -#10 FRAC	TION + TAKE (g);	293.96	TARE (g)	136.69	1	SIZE	FINER	1		L	J
WEIGHT OF + #10 FD A	TON, AIR DRY (g):	186.82	3"	136.69	<del>-</del> f	ll .					
WEIGHT OF +#10 FRAG	ION, AIR DRY (g):	956.44	2"		100.0%	3"	100.0%		OLOR:		
OVEN DRY WEIGHT OF	FINES (g):	173.30	1"	258.73	88.8%	2"	88.8%		live black (5	V 2/1)	
OVEN DON WEIGHT OF	COARSE FRACTION (g):	915.24	3/4"	448.13	71.4%	1"	71.4%	1	The Glack (3	1 4/1),	]
OVEN DRY WEIGHT OF	TOTAL SAMPLE (g):	1088.54	-	634.56	• 54.3%	3/4"	54.3%	1 5	ECCD INTER		
			3/8"	838.7	35.5%	3/8"	35.5%	]	ESCRIPTION	N:	
ANDROMETE	TEST ON FINE FRACTION	- 1	#4	940.8	26.1%	#4	26.1%	C-1	UKAVEL,	some c-f sand,	
		1	#10	1025.5	18.3%	#10	18.3%	l fr	ace clavey silt.	, (GP).	
HYDROMETER TYPE:	152H					#20	12.5%	1	_		
HYDROMETER NUMBE	R: 15-1515	<u> </u>			!	#40		1	USCS:	GP	
BEAKER NUMBER:	13	ľ				#60	7.6%	1			
FLASK NUMBER:	8	1	PART G: S	SIEVE OF -#	10	#100	4.8%	1			
SPECIFIC GRAVITY:	2.65	1				#200	3.5%	i	LL:		
PORTION TESTED:	-#10			CUM	PERCENT	•	2.8%	ł	PL:	<del></del>	
MOIST WT. OF SOIL (g):	70.03	1		WEIGHT	FINER	0.0490	2.8%	ł	PI:	<del></del>	
CORRECTED DRY WT (	78.03	1			· ·····	0.0288	2.0%	j		L	
Rm:	72.38	1.	TARE (g)	136.61	11	0.0180	1.4%	1			
	1	1	#20	159.62	68.2%	0.0115	0.9%	1	D10:	0.60	
	77773 4	- 1	#40	179.11	- 11	0.0067	0.4%	}	D30:	6.3	
STANDARD SOLUTION	TEMP. READ.	1	#60	189.95	41.3%	0.0039	0.3%		D60:		
ZERO CORRECTION	26.3 4.0	1	#100	195,34	26.3%	0.0024	0.2%		Cu:	21	
OWECTION	19.1 6.5	1	#200	193.34	18.9%	0.0014	0.0%	İ	Cu: Cz:	35.0	
			" <del>-200</del> [	197.91	15.3%				CZ:	3.2	
	ELAPSED		ZERO	CODE				I ·			
D HR M	TIME TEMP. F	HYDRO		CORR.	CORR.		EFF.	CONSTANT			
D HR M			(CONT.)	FACTOR	FACTOR	% FINER	DEPTH	(T&Gs)	<b>D</b>		
12 10 6			(5011.)		<u>a</u>		L,cm	K	DIAM.	LOG	%TOTAL
	0.0								(mm)	DIAM	SAMPLE
12 10	0 1.0 22.0	16.0									
12	0 3.0 22.0	13.0	5.5	0.4	1.0	15.1%	13.507	0.01222			
12 10 14	0 8.0 21.9	11.0	5.5	0.4	1.0	10.9%	13.999	0.01332	0.0490	-1.31	2.8%
12 10 26	0 20.0 21.8		5.5	0.2	1.0	7.8%	14.327	0.01332	0.0288	-1.54	2.0%
12 11 6	0 60.0 21.6	9.0	5.6	0.2	1.0	5.0%		0.01348	0.0180	-1.74	1.4%
12 13 6	A	7.0	5.6	0.2	1.0		14.655	0.01348	0.0115	-1.94	
12 18 6	0	6.5	5.6	0.2	1.0	2.2%	14.983	0.01348	0.0067		0.9%
13 9 6	21.8	6.0	5.6	0.2	1.0	1.5%	15.065	0.01348	0.0039	-2.17	0.4%
	0 1380.0 19.3	6.8	6.4	-0.3		0.9%	15.147	0.01348	0.0039	-2.41	0.3%
				V.J	1.0	0.1%	15.016	0.01382	0.0014	-2.62	0.2%
OJECT: MO	A CAITO TO . TO							-	V.UU [4	-2.84	0.0%
1710	NASNTO/RI/FS SEDIMENT/ID								<del></del>		
CUNICIAN	101.603	r	DATE:					രവ	DED Accor	TATION	
CHNICIAN: MF			EVIEWED		0-93			GOL	DER ASSOC	CIATES INC. L TESTING LABOI	
			<u></u>	BY: DP				GEU	LCUMNICAL	L LESTING LABOR	1

WORKSHIET FOR HYDROMICTER AND SHAVE AST 22 (MODIFIED FOR TEMPERATURE CHANGE WORKSHEE). R.DRY PREPARATION OF SOILS						E CHANGE)		MATURAL	MORSTURE	PART C.	#10 MOIST	URE	PART D:	1#10 MOI	STURE	
WORKS	HEB.	R.DI	RY PREPA	ARATION OF	SOILS	<b>,</b>	TARE #:			TARE #:		26	TARE #:		г	
<u> </u>	ASTM D	-421		,			TARE (g):			TARE (g):		76.28	TARE (g)		}	69.68
WORKS	HEET F	OR MO	DISTURE	CONTENT O	FSOILS	•	MOIST W	E. (e):		MOIST W		239.19	MOIST		ŀ	
	ASTM D						OVEN DR				Y WT (g):	226.64		v 1. (g): RY WT (g):	}	477.3
1	UPDATI	ED 11/	26/91 BY	D. OSTER			W%:	(6).	<u> </u>	W%:	(1 W1 (g):	8.3%		KIWI(g):	L	454.7
PART B:							PARTE: S	IEVE OF	L#10	, W /b.		8.3%	W%:			5.9%
1									1 17-10	FINAL	RESULTS		DDING.			
WEIGHT	TOTA	LSAM	PLE + TA	ARE, AIR DRY	( (g):	852.70	ł	CUM	PERCENT	I I'MAL	VESOFIS	1	ORING:	0000 1200		
WEIGHT					(6)	107.11	1	WEIGHT		GRAIN	PERCENT	1	AMPLE:	SCSS-1200		
WEIGHT				•		107.11			IIILI	SIZE		ן ויי	EPTH:			
				TARE (g):		445.04	TARE (g)	136.60	7	SIZE	FINER					
				AIR DRY (g):		337.93	3"	136.60		1 -	100.00		o. o.			
				AIR DRY (g):		407.66	2"	136.60		3" 2"	100.0%		OLOR:			
OVEN D						311.90	1"	163.85		11 .	100.0%	[0]	live black (5 Y 2	2/1),		
				SE FRACTIO	N (a)	385.02	3/4"	212.34	_	1"	96.1%	1				
				L SAMPLE (g)		696.92	3/8"	314.22	(	3/4"	89.1%		DESCRIPTION:			
			3. 1011	E OT HAT ELE (E	,	070.72	#4	<del></del>	<b>⊣</b>	3/8"	74.5%		GRAVEL and			1
PART F:	HYDR	омет	ER TEST	ON FINE FRA	CTION		#10	411.57 481.02		#4	60.5%	so	me clayey silt, (	GM).		
			DIV I DO I	ONTINETRA	CHOI		710	481.02	50.6%	#10	50.6%	1				
HYDRO	METER	TYPE		152H			<b>[</b>			#20	45.5%	1	USCS:	GM		
HYDRO				15-1515						#40	38.6%	1				
BEAKER			DEN.	15-1315			PART G: S	VEVE OF	410	#60	31.4%	1				
FLASK N				<del>  3</del>			I FART U:	NEVE OF -	#10	#100	27.1%	1	LL:			
	PECIFIC GRAVITY: 3.02						CUL	BEDOENE	#200	24.2%	i	PL:				
PORTIO				-#10				CUM	PERCENT	0.0443	18.8%	j	PI:	L		
MOIST V			·)·	69.84			Į.	WEIGHT	FINER	0.0270	13.0%	ł				
CORREC				64.46			TARE (g)	126 (1	7	0.0171	9.4%	Ì				
Rm:			(6).	1.				136.61		0.0111	7.8%	•	D10:	N/A		
				• .			#20	143.03		0.0065	5.2%		D30:	N/A		
				ТЕМР.	READ.		#40	151.83	-	0.0038	3.3%		D60:	N/A		
STANDA	ARD SOI	UTIO	N	26.3	4.0		#60	161.00		0.0024	1.2%		Cu:	N/A		
ZERO C			•	19.1	6.5		#100	166.52	<del></del>	0.0014	0.2%		Cz:	N/A		
	0111120			17.1	C+0		#200	170.29	47.8%		•					
				ELAPSED			ZERO	CORR.	CORR.	L						
				TIME		HYDRO	CORR.		FACTOR	or Enter	EFF.	CONSTANT				
D	HR	M	S	(min.)	(C)	READING	(CONT.)			% FINER		(T&Gs)	DIAM.			%TOTAL
				()		KEADING	(CONT.)	t	<u>a</u> .		L,cm	<u> </u>	(mm)		DIAM:	SAMPLE
12	10	17	0	0.0												
12	10	18	-	1.0	22.1	31.0	5.5	0.4	0.9	27 201	11.047	0.01000				
12	10	20	0	3.0	22.1		5.5	0.4		37.3%		0.01332	0.0443		-1.35	18.8%
12	10	25	0	8.0	22.0	18.0	5.5	0.4		25.8%		0.01332	0.0270		-1.57	13.0%
12	10	37		20.0	21.9	16.0	5.5			18.5%		0.01332	0.0171		-1.77	9.4%
12	11	17	0	60.0	21.7	12.5	5.6	0.2 0.2		15.3%		0.01348	0.0111		-1.96	7.8%
12	13	17	Ö	180.0	21.6	10.0	5.6	0.2		10.2%		0.01348	0.0065		-2.19	5.2%
12	18	7	0	470.0	21.8	7.0	5.6	0.2		6.6%		0.01348	0.0038		-2.42	3.3%
13	9	17		1380.0	19.4	7.0	6.4	-0.2 -0.3		2.4%		0.01348	0.0024		-2.62	1.2%
					****		0.4	-0.5	0.9	0.4%	14.983	0.01382	0.0014		-2.84	0.2%
		_								<del></del>		<del></del>	·			<del>" - · · · · · · · · · · · · · · · · · · </del>
PROJEC			MONAS	NTO/RI/FS SE	DIMENT	/ID						C)	ULUED YES	CIATES IN	•	
PROJECT NUMBER: 923-1101.603				DATE:		1-10-93	•			OLDER ASSO EOTECHNICA			D ATONY			
TECHNI	CIAN:		MF				REVIEW	ED BY:	DPO				EDMOND, WA			KAIUKY
	естисти. мг													IO I Drill Los	1	

WORKSHIP FEOR HYDROMETER AND SIEVE	PARTA:	NATURAL.	MOISTURE	Leaders	-#10 MOIS	*****	·- p ·- ·- ·			
ASTM D-422 (MODIFIED FOR TEMPERATURE CHANGE WORKSHEET FOR DRY REFERANCE OF THE WORKSHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR DRY REFERANCE OF THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR THE WORK SHEET FOR	)			IAKI (.	-# 10 MO12	rokt.	PARTD	D: +#10 MOISTUI	RE:	
WORKSHEET FOR DRY PREPARATION OF SOILS ASTM D-421	TARE #:			TARE #:	<b>.</b>	E	TARE #	<b>L</b> . ,		
WORKSHEET FOR MOISTURE CONTENT OF SOILS	TARE (g)			TARE (g		89.96	TARE (		26	
ASTM D-2216	MOIST W			MOIST V	VT. (g);	231.22	MOIST	5 <i>)•</i> WT (a)•	76.26 88.60	
UPDATED 11/26/91 BY D. OSTER	W%:	RY WT (g):	L	OVEND	RY WT (g):	222.64		ORY WT (g):	87.99	
PART B: SEPARATION OF FRACTIONS		SIEVE OF +	410	W%:		6.5%	W%:	(6).	5.2%	
		SIEVE OF T	#10	FTATAT	D. T. a					
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 337.68		CUM	PERCENT	FINAL	RESULTS	BORING: SAMPLE: SCSS-2400				
WEIGHT OF AIR DRY TARE (g): 357.08  107.10	WEIGHT FINER			GRAIN	PERCENT	S	]			
WEIGHT OF -#10 TARE (g): 107.10 WEIGHT OF -#10 FRACTION + TARE (g): 325.34	i			SIZE	FINER	_	EPTH:		j	
WEIGHT OF #10 ED ACTION AID DOG	TARE (g)	76.28		J	LINER					
I WEIGHT OF 1 #10 ED A CTON AND THE	3"	76.28	100.0%	3".	100.0%		OLOR:	•		
HOVEN DRY WEIGHT OF TIMES ( )	2"	76.28	100.0%	2"	100.0%		ownish black (	5 VP 2/1)		
OVEN DRY WEIGHT OF FINES (g): 204.98 OVEN DRY WEIGHT OF COARSE FRACTION (g): 11.73	1"	76.28	100.0%	1"	100.0%	-	ownian olack (.	J 1 K 2/1),		
OVEN DRY WEIGHT OF TOTAL SAMPLE (g): 216.71	3/4"	76.28	100.0%	3/4"	100.0%	D	ESCRIPTION:			
	#4	76.28 80.00	100.0%	3/8"	100.0%			and m-f SAND,		
PART F: HYDROMETER TEST ON FINE FRACTION	#10	86.59	98.3% 95.2%	#4	98.3%	tra	ice f gravel, (M	L).		
LIVDROVETER	] "-*	00.57	73.270	#10 #20	95.2%	}				
HYDROMETER TYPE: 152H HYDROMETER NUMBER: 15-1515				#40	91.5% 84.9%		USCS:	ML		
DEAVED AUTOER	-			#60	77.8%					
FLASK NUMBER: 4	PART G:	SIEVE OF -#	10	#100	71.8%	İ	LL:			
SPECIFIC GRAVITY: 2.56			ĺ	#200	65.2%		PL:	<del>  </del>		
PORTION TESTED: -#10	4		PERCENT	0.0417	50.7%	ł	PI:	<del></del>		
MOIST WT. OF SOIL (g): 66.61		WEIGHT	FINER	0.0249	44.5%					
CORRECTED DRY WT (g): 62.56	TARE (g)	73.38		0.0160	35.3%					
Rm:	#20	75.86	96.0%	0.0103	30.7%		D10:	N/A		
	#40	80.20	89.1%	0.0061 0.0044	23.4%		D30:	N/A		
STANDARD SOLUTION TEMP. READ.	#60	84.86	81.7%	0.0024	19.0% 12.0%		D60:	N/A		
ZERO CORRECTION	#100	88.81	75.3%	0.0013	7.4%		Cu:	N/A		
ZERO CORRECTION 19.4 8.0	#200	93.09	68.5%	_	******		Cz:	N/A		
ELAPSED	ZERO	CODD								
TIME TEMP. HYDRO	CORR.	CORR. FACTOR	CORR.	~	EFF.	CONSTANT	<u> </u>			
D HR M S (min.) (C) READING	(CONT.)	t		% FINER		(T&Gs)	DIAM.	LOG	%TOTAL	
22 10 56		•	<u>a</u>		L,cm	K	(mm)		SAMPLE	
22 10 56 0 0.0 22 10 57 0 10 214 400								-		
27 10 50 0 1.0 21.4 40.0	7.5	0.2	1.0	53.2%	9.571	0.01348				
22 11 30.0	7.5	0.2	1.0	46.7%	10.227	0.01348	0.0417	-1.38	50.7%	
22 11 16 0 20.0 21.7 27.0	7.4	0.2	1.0	37.0%	11.211	0.01348	0.0249 0.0160	-1.60	44.5%	
22 11 56 0 60.0 22.0 22.0	7.4	0.2	1.0	32.2%	11.703	0.01348	0.0103	-1.80 -1.99	35.3%	
22 12 56 0 120.0 22.6 19.0	7.3 7.2	0.4	1.0	24.5%	12.523	0.01332	0.0061	-1.99 -2.22	30.7% 23.4%	
22 17 44 0 408.0 23.3 14.0	7.2 7.0	0.4 0.7	1.0	19.9%	13.015	0.01332	0.0044	-2.36	19.0%	
23 11 21 0 1465.0 20.5 12.5	7.7	0.7	1.0	12.6%	13.835	0.01317	0.0024	-2.62	12.0%	
		V.U	1.0	7.8%	14.081	0.01365	0.0013	-2.87	7.4%	
PROJECT: MONASNTO/PI/ES SEINACHTER										
PROJECT: MONASNTO/RI/FS SEDIMENT/ID PROJECT NUMBER: 923-1101.603						CO	DED ASSOC			
TECHNICIAN: MF	DATE:		10-93			GE	LDER ASSOC	IATES INC.		
	REVIEWE	DBY: D		·		REI	OMOND, WAS	TESTING LABO	RARY	

WORKSHEET FOR HYDROMETER AND SHEVE	T PARTA N	NATÜRÄÜ	MURE	1 BADE						
AST 122 (MODIFIED FOR TEMPERATURE CHANGE		WIT OKAL.	UKE	PARTC:	-#10 MOIS	TURE	PART D: 4	PART D: +#10 MOISTURE		
WORKSHEL OR DRY PREPARATION OF SOILS	TARE #:			TARE#:		S-1	TARE #:	r		
ASTM D-421 WORKSHEET FOR MOISTING COMMENT OF STATE	TARE (g):			TARE (g)		70.06	TARE #:	ŀ		
WORKSHEET FOR MOISTURE CONTENT OF SOILS ASTM D-2216	MOIST WI			MOIST W	T. (g):	136.75	MOIST WT	. (0):	0.00	
UPDATED 11/26/91 BY D. OSTER	OVEN DR	Y WT (g):		OVEN DE	RY WT (g):	134.77	OVEN DRY		0.00	
PART B: SEPARATION OF FRACTIONS	W%:	Interior		W%:		3.1%	W%:	(e). [	0.0%	
	PART E: S	IEVE OF +	#10						0.070	
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 333.28		CUM	PERCENT	FINAL	RESULTS	1	RING:			
WEIGHT OF AIR DRY TARE (g):		WEIGHT	FINER	GDAIN	PERCENT	SA	MSSS-100			
WEIGHT OF -#10 TARE (g): 107 11	1	Dioiii	THILE	SIZE	FINER	DE	PTH:			
WEIGHT OF -#10 FRACTION + TARE (g): 333.28	TARE (g)	0.00	]	Size	FINER	İ				
WEIGHT OF -#10 FRACTION, AIR DRY (g): 226.17	3"	0.00	100.0%	3"	100.0%		LOR:			
WEIGHT OF +#10 FRACTON, AIR DRY (g): 0.00 OVEN DRY WEIGHT OF FINES (g): 219.46	2"	0.00	100.0%	2"	100.0%		ownish black (5 Y	/D 2/1\		
OVEN DRY WEIGHT OF GO . DOT	1"	0.00	100.0%	1"	100.0%	1	witish black (5.1	K 41),		
LOVEN DDV WEIGHT OF TOTAL ALLES	3/4"	0.00	100.0%	3/4"	100.0%	DE	SCRIPTION:			
OVEN DRT WEIGHT OF TOTAL SAMPLE (g): 219.46	3/8"	0.00	100.0%	3/8"	100.0%		AYEY SILT, son	ne f sand.		
PART F: HYDROMETER TEST ON FINE FRACTION	#4	0.00	100.0%	#4	100.0%	(M		<b>-</b>	1	
1	#10	0.00	100.0%	#10	100.0%					
HYDROMETER TYPE: 152H	1			#20	99.4%		USCS: M	ИL		
HYDROMETER NUMBER: 15-1515	<del></del>	<del></del>		#40	98.0%		_			
BEAKER NUMBER: 3	PART G: S	IEVE OF #	10	#60 #100	95.7%	1	_			
FLASK NUMBER: 7	]	-2 - 2 - 3 - 3	1	#200	89.5%	i	LL:		;	
SPECIFIC GRAVITY: 2.40		CUM	PERCENT	0.0399	77.7% 62.1%		PL:			
PORTION TESTED: -#10 MOIST WT. OF SOIL (g): 69.06	l	WEIGHT	FINER	0.0258	41.0%		PI:			
CORDECTED	l _			0.0165	31.5%					
Dm.	TARE (g)	136.65		0.0109	21.3%		D10: [1	N/A		
1	#20	137.03	99.4%	0.0064	15.8%	İ	<u> </u>	N/A		
TEMP. READ.	#40	137.96	98.0%	0.0038	11.1%		· · · · · · · · · · · · · · · · · · ·	N/A		
STANDARD SOLUTION 26.3 4.0	#60	139.56	95.7%	0.0023	6.5%		<u> </u>	N/A		
ZERO CORRECTION 19.1 6.5	#100 #200	143.69	89.5%	0.0014	3.5%			N/A		
	#200 L	151.60	77.7%				-			
ELAPSED	ZERO	CORR.	CORR.		EFF.	CONSTANT				
TIME TEMP. HYDRO D HR M S (min) (C) READING	CORR.	<b>FACTOR</b>		% FINER		(T&Gs)	DIAM			
D HR M S (min.) (C) READING	(CONT.)	t	a		Lem	K	DIAM. (mm)		TOTAL	
12 9 55 0 0.0							(mm)	DIAM S	AMPLE	
12 9 56 0 1.0 21.8 45.0	• •								1	
12 9 58 0 3.0 21.8 31.5	5.6	0.2	1.1	62.1%	8.751	0.01348	0.0399	-1.40	62.1%	
12 10 3 0 8.0 21.7 25.5	5.6 5.6	0.2	1.1	41.0%	10.965	0.01348	0.0258	-1.59	41.0%	
12 10 15 0 20.0 21.6 19.0	5.6	0.2 0.2	1.1	31.5%	11.949	0.01348	0.0165	-1.78	31.5%	
12 10 55 0 60.0 21.6 15.5	5.6	0.2	1.1 1.1	21.3%	13.015	0.01348	0.0109	-1.96	21.3%	
12 12 55 0 180.0 21.6 12.5	5.6	0.2	1.1	15.8%	13.589	0.01348	0.0064	-2.19	15.8%	
12 17 55 0 480.0 21.8 9.5	5.6	0.2	1.1	11.1% 6.5%	14.081 14.573	0.01348	0.0038	-2.42	11.1%	
13 9 55 0 1440.0 19.2 9.0	6.5	-0.3	1.1	3.5%	14.655	0.01348	0.0023	-2.63	6.5%	
		_		J.J 70	17.033	0.01382	0.0014	-2.86	3.5%	
PROJECT: MONASNTO/RI/FS SEDIMENT/ID	····									
PROJECT NUMBER: 923-1101.603						GOI	DER ASSOCIA	TES INC		
TECHNICIAN: MF	DATE:	1	1-10-93			GEO	TECHNICAL T	TESTING I AROP	ATORY	
	REVIEWE	ORA: I	OPO	GEOTECHNICAL TESTING LABORATORY REDMOND, WASHINGTON				AIURI		

SAMPLE 50% -600

Pycnometer number	L0213		
Temperature at weighings ( ^O C)	71.8		
Weight flask + soil + water (W _b )	70076		
Weight flask + water (Wa)	651-47		
(Wa - Wb)	-43.79		
Evaporating dish number	8		
Weight dish + dry soil	69,86		·
Weight dish	0		
Weight dry soil (Wo)	69.86		
Temperature factor (K)	9936		

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \bullet K$$
 2 6 2

Comments:

## Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854



SAMPLE 50 55-900

Pycnometer number	10713	
Temperature at weighings ( ^O C)	70.5	
Weight flask + soil + water (W _b )	697,49	
Weight flask + water (Wa)	656 55	
(Wa - Wb)	- 40.94	
Evaporating dish number	6A	
Weight dish + dry soil	65,67	
Weight dish	0	
Weight dry soil (W ₀ )	. 65.69	
Temperature factor (K)	,9937	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_S/20^{\circ}C = \frac{W_0}{W_0 + (W_a \cdot W_b)} \cdot K = 2.65$$

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. ______ Date _____ Tested By _____ Approved By _____ D// @ Golder Associates

SAMPLE	<u> 5055</u>	~ 1200
SAMELE		

<del></del>				,
Pycnometer number	L0208		T	T
Temperature at weighings ( ^O C)	21.5			<del> </del>
Weight flask + soil + water (Wb)	702.86			<del> </del>
Weight flask + water (Wa)	658.70			
(Wa - W _b )	_441,16			
Evaporating dish number	13			
Weight dish + dry soil	66.04			
Weight dish	0			
Weight dry soil (Wo)	66.04			
Temperature factor (K)	, 4447			·
		i i		

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \cdot K = 5.02$$

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project		7 8 4 7 17.	-:		
Project No.	28 x 3x 2 3 x 2	Date	7-4-4 8		
			Tested B	Approved By	Golder Associates

#### SAMPLE 5045 -2400

Pycnometer number	10 208	
Temperature at weighings (OC)	71.8	
Weight flask + soil + water (Wb)	69867	
Weight flask + water (Wa)	69864	
(W _a - W _b )	-40.09	
Evaporating dish number	13	
Weight dish + dry soil	65.68	
Weight dish	0	
Weight dry soil (Wo)	. 65.68	
Temperature factor (K)	. 9996	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 915-1101 100 Date 113 Decled By Approved By DO @ Golder Associates

SAMPLE	M	55	, Ç,	-	00

Due to the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of				
Pycnometer number	LO 213			
Temperature at weighings (OC)	22.5			
Weight flask + soil + water (W _b )	694,22			<del> </del>
Weight flask + water (Wa)	656,48			
(Wa - Wb)	-37.74			-
Evaporating dish number	12			
Weight dish + dry soil	64.63	<del></del>		<del> </del>
Weight dish	O			
Weight dry soil (Wo)	64.65		<del>-  </del>	
Temperature factor (K)	, 9996			

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \cdot K = 2.40$$

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

A CONTRACTOR OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY O									
WORKSHEET FOR HYDROMETER AND SIEVE	PARTA	NATURAL	Moleston	T = . = = =				•	
ASTM (MODIFIED FOR TEMPERATURE CHANGE	7	. MATURAL	. MOISTERE	PART C:	-#10 MOIS	TURE	PART D:	+#10 MOISTU	RE
DRY PREPARATION OF SOILS	TARE #:			T. D					
ASTM D-421	TARE (g		<b> </b>	TARE #		R	TARE #:		5.0
WORKSHEET FOR MOISTURE CONTENT OF SOILS	MOIST V	/· VT. (σ)·	<del>  </del>	TARE (g	): !***	107.09	TARE (g)		90.10
ASTM D-2216	OVEND	RY WT (g):	<b> </b>	MOIST V	VI. (g):	2111 8	MOIST W	VT. (g):	1472.05
UPDATED 11/26/91 BY D. OSTER	W'%:		ERR	W%:	RY WT (g):	216.612		RY WT (g):	727,30
PART B: SEPARATION OF FRACTIONS	PARTE:	SIEVE OF	+#10	W 70:		ERR	W%:		ERR
WEIGHT TOTAL CAMPLE A TOTAL	1			FINAL	RESULTS	1 _			
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): WEIGHT OF AIR DRY TARE (g):	1	CUM	PERCENT		WESOF 12	1	ORING:		_}
WEIGHT OF HIATARE	[	WEIGHT		GRAIN	PERCENT		AMPLE:	>655-600	2
WEIGHT OF AIR COLORS	ľ			SIZE	FINER	"	EPTH:	L	
WEIGHT OF #10 FD ACTION AIR DRIVES	TARE (g)	40.0%	] .			1			
I WEIGHT OF 1#10 FD ACTON AID DOW!	3"		ERR	3"	ERR	1 0	OLOR:		
IUVEN DRY WEIGHT OF CIVES ( )	2"	<u> </u>	ERR	2"	ERR			Coch (SYR	<del></del>
IOVEN DRY WEIGHT OF COADER TO A TOTAL	1"	280,66	CRR	1"	ERR	4	אניי וואר ביי	ach (54R	2/1)
IOVEN DRY WEIGHT OF TOTAL ALLERS	3/4"	316.63	ERR	3/4"	ERR	ום	ESCRIPTION:		
	3/8"	570.0	H	3/8"	ERR		- Colta Fiore	<del></del>	<del></del>
PART F: HYDROMETER TEST ON FINE FRACTION	#4	571.88	ERR	#4	ERR		Charge sil	.]	ŀ
	#10	685,76	J ERR	#10	ERR				
HYDROMETER TYPE: 152H				#20	ERR	1	USCS:		
HYDROMETER NUMBER: 15-1515	·			#40	ERR	1	•		
BEAKER NUMBER:	PARTG	SIEVE OF -		#60	ERR			•	
FLASK NUMBER:	1711(1 0.	21E 4 E OF -1	10	#100	ERR		LL:		
SPECIFIC GRAVITY:		СИМ	PERCENT	#200	ERR		PL:		
PORTION TESTED: -#10	•	WEIGHT	FINER	ERR	ERR		PI:		
MOIST WT. OF SOIL (g):		" LIGITI	PINER	ERR	ERR		•		
CORRECTED DRY WT (g): ERR	TARE (g)	77330	i li	ERR	ERR .				
Rm:	#20	84.60	ERR	ERR	ERR		D10: [		
	#40	14 Deg	ERR	ERR ERR	ERR		D30:		
STANDARD SOLUTION TEMP. READ.	#60		ERR	ERR	ERR		D60:		
ZEDO CODERCEMENTO	#100	105,70	ERR	ERR	ERR ERR		Cu:	]	
NERO CORRECTION 27 6	#200	10 06	ERR	21/1/	EKK		Cz:		1
ELAPSED					·				
TIME TEMP. HYDRO	ZERO	CORR.	CORR.		EFF.	CONSTANT			
D HR M S (min.) (C) READING	CORR.	FACTOR	FACTOR	% FINER	DEPTH	(T&Gs)	DIAM.	100	%TOTAL
	(CONT.)		a		L,cm	K	(mm)		SAMPLE
77 10 45 0 0.0								- OH WI	SAMILE
- 0 0.0 21,4 37	ERR	ERR	1.5	F2.5		•			Ì
- 0 0.0 21.4 32	ERR	ERR	1.5 1.5	ERR	16.131	ERR	ERR	ERR	ERR
0 0.0 21.5 77	ERR	ERR	1.5	ERR ERR	16.131	ERR	ERR	ERR	ERR
0 0.0 71.6 73.5	ERR	ERR	1.5		16.131	ERR	ERR	ERR	ERR
- 10 HE 0 0.0 22.0 17.5	ERR	ERR	1.5	ERR ERR	16.131	ERR	ERR	ERR	ERR
0 0.0 22.6 15	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR
1 4 0 0.0 23.4 12	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR
0 0.0 20.5 11.5	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR
				LAK	16.131	ERR	ERR	ERR	ERR
PROJECT: Monsanto RT FS Sociency	100			<del></del>					
" " " " " " " " " " " " " " " " " " "	_					COL	DED ASSO	4 5555	
ECHNICIAN: MF/DPO	DATE:	Ų	10-93			OOL	DER ASSOCIA	ATES INC.	i i
	REVIEWE	D BY:	200			DEC	MOND WAS	TESTING LABO	RATORY
						NCL.	MOND, WASH	INGTON	i

WORKSHEET FOR HYDROMETER AND SIEVE	PARTA: NATURAL	A4/ \15'17 10 12	1 0 4 10 20 45				
ASTM D-422 (MODIFIED FOR TEMPERATURE CHANGE)	TAKE AS TATORAL	MOISTORE	PART C	-#10 MOIST	TURE	PART D:	+#10 MOISTURE
WORKSHEET FOR DRY PREPARATION OF SOILS	TARE #:		TARE #:			1	
ASTM D-421	TARE (g):		TARE (g)		100	TARE #:	B
WORKSHEET FOR MOISTURE CONTENT OF SOILS	MOIST WT. (g):	<del></del>	MOIST W	j. VT (a).	77.85	TARE (g):	156.86
ASTM D-2216	OVEN DRY WT (g):		OVEND	r 1. (g): RY WT (g):	185.61	MOIST WI	
UPDATED 11/26/91 BY D. OSTER	N'%:	ERR	W%:	(K 1 W 1 (g):	ERR	OVEN DR	
PART B: SEPARATION OF FRACTIONS	PART E: SIEVE OF				T EKK	W%:	ERR
WEIGHTOTHE			FINAL	RESULTS	ROB	ING: T	
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 1250.4	CUM	PERCENT					35-900
WEIGHT OF AIR DRY TARE (g):	WEIGHT	` FINER	GRAIN	PERCENT	DEP		333-100
WEIGHT OF -#10 TARE (g): WEIGHT OF -#10 FRACTION + TARE (g):		_	SIZE	FINER		L	
WEIGHT OF HIS ED ACTION AND DOLL	TARE (g) 136-61	_					
IWEIGUT OF A MAKEN A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY AND A COMPANY A	3"	ERR	3"	ERR	COL	OR:	
IOVEN DRY WEIGHT OF STATE	2" 759.73	<b>-</b>	2"	ERR		ve black	(5 4 2/1)
OVEN DRY WEIGHT OF FINES (g):  ERR OVEN DRY WEIGHT OF COARSE FRACTION (g):  ERR	1" 448.13		1"	ERR	]		
OVEN DRY WEIGHT OF TOTAL SAMPLE (g): ERR	3/4" 624.56	1	3/4"	ERR	DES	CRIPTION:	
ERR	3/8" 939.7 #4 440.9	ERR	3/8"	ERR			
PART F: HYDROMETER TEST ON FINE FRACTION	<del></del>	- 1	#4	ERR	CI	<u></u>	
	#10 NOZS.5	J ERR	#10	ERR	1		
HYDROMETER TYPE: 152H			#20	ERR		USCS:	
HYDROMETER NUMBER: 15-1515			#40 #60	ERR	l		
BEAKER NUMBER:	PART G: SIEVE OF-	#10	#100	ERR ERR		~	
FLASK NUMBER:			#200	ERR		LL:	
SPECIFIC GRAVITY:	CUM	PERCENT	ERR	ERR		PL: PI:	
PORTION TESTED: -#10 MOIST WT. OF SOIL (g): 7 1/3 0 1/2	WEIGHT	FINER	ERR	ERR		rı: [	
CODDECTOR			ERR	ERR .			
CORRECTED DRY WT (g): ERR	TARE (g) 136.61		ERR	ERR		D10:	(6)
1	#20 159-62	ERR	ERR	ERR		D30:	.60
TEMP. READ.	#40 179.11	ERR	ERR	ERR		D60:	6.5
STANDARD SOLUTION TEMP. READ.	#60 19(1.15	1 !!	ERR	ERR		Cu:	
ZERO CORRECTION	#100 195.34 #200 197.91	4 B	ERR	ERR	•	Cz:	
	#200	J ERR				_	
ELAPSED	ZERO CORR.	CORR.		Cor.	ACUS III		
TIME TEMP. HYDRO		FACTOR	% FINER	EFF.	CONSTANT		
D HR M S (min.) (C) READING	(CONT.)	a	75 T T. D.	Lcm	(T&Gs) K	DIAM.	LOG %TOTAL
12 10 6 0 00						(mm)	DIAM SAMPLE
	ERR ERR	1.5	ERR	16.131	ERR	ERR	ERR ERR
, , , , , , , , , , , , , , , , , , ,	ERR ERR	1.5	ERR	16.131	ERR	ERR	ERR ERR ERR ERR
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	ERR ERR	1.5	ERR	16.131	ERR	ERR	ERR ERR
11 6 0 0.0 71 8 9 13 6 0 0.0 71 6 7 18 6 0 0.0 71 6 5 18 6 0 0.0 71 6 5	ERR ERR	1.5	ERR	16.131	ERR	ERR	ERR ERR
13 6 0 0.0 21.6 5	ERR ERR	1.5	ERR	16.131	ERR	ERR	ERR ERR
18 6 0 0.0 Z1.8 U	ERR ERR	1.5	ERR	16.131	ERR	ERR	ERR ERR
18 6 0 0.0 21.8 4	ERR · ERR	1.5	ERR	16.131	ERR	ERR	ERR ERR
	ERR ERR	1.5	ERR	16.131	ERR	ERR	ERR ERR
Maria de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya de la companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya della companya	1 -	<del></del>					
PROJECT: Monsanto/ 127 FS Socienty	ハラ					•	
PROJECT NUMBER: 913-1101.1603	DATE:	- 10-93	•		GOLD	ER ASSOCIA	TES INC.
TECHNICIAN: MF/DPO	REVIEWED BY:	7			GEOT	ECHNICAL T	ESTING LABORATE
		T			REDM	HZAW , DNO	INGTON

WORKSHIFET FOR HYDROMETER AND SIEVE	I PART A	NATURAL	MOMENTE	l BABBS.					
ASTM (MODIFIED FOR TEMPERATURE CHANGE	3)	WITCHALL	WC (IS	rakte;	-#10 MOIS	IURE	PART D: +#	10 MOISTURE	
WORKSHEET DRY PREPARATION OF SOILS	TARE #:	!		TARE #:		26	TARE #:		
ASTM D-421	TARE (g)			TARE (g)		7628	TARE (g):		M (2)
WORKSHEET FOR MOISTURE CONTENT OF SOILS	MOIST V			MOIST W	/T. (g):	239.9	MOIST WT.		69.68
ASTM D-2216 UPDATED 11/26/91 BY D. OSTER		RY WT (g):		OVENDE	RY WT (g):	276.64	OVEN DRY V	: Ի	477.34 454.70
PART B: SEPARATION OF FRACTIONS	N'%:		ERR	W%:		ERR	W%:	(8).	ERR
STATE OF TRACTIONS	PARTE:	SIEVE OF +	#10						
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 852,7		CUM	DEDOENT	FINAL	RESULTS	ВО	RING:		
WEIGHT OF AIR DRY TARE (g):		WEIGHT	PERCENT FINER	CDAN	000 00.00	i i	MPLE:	55-1200	
WEIGHT OF -#10 TARE (g):	ŀ	WEIGHT	riner.	GRAIN SIZE		DE	PTH:		
WEIGHT OF -#10 FRACTION + TARE (g):	TARE (g)	136.60	1	3126	FINER				**
WEIGHT OF -#10 FRACTION, AIR DRY (g): 0.00	3"	170.00	ERR	3"	ERR		1.00		
WEIGHT OF +#10 FRACTON, AIR DRY (g): 0.00	2"	<del></del>	ERR	2"	ERR		LOR:	f	<del>\</del>
OVEN DRY WEIGHT OF FINES (g): ERR	1*	162.95	ERR	1"	ERR		1. c black	15 / 2/·	إ لــــــــــــــــــــــــــــــــــــ
OVEN DRY WEIGHT OF COARSE FRACTION (g): ERR	3/4"	212.34	ERR	3/4"	ERR	DE	SCRIPTION:		
OVEN DRY WEIGHT OF TOTAL SAMPLE (g): ERR	3/8"	314.22	ERR	3/8"	ERR	1 -	SCRII HOR.	<del></del>	
PARTE UVDPOMETER TECTION TO THE TOTAL	#4	411.57	ERR	#4	ERR	1 1	1. 5:14	•	1 1
PART F: HYDROMETER TEST ON FINE FRACTION	#10	461.02	ERR	#10	ERR	<u> </u>			
HYDROMETER TYPE: 152H	1		4	#20	ERR	1	USCS:		ł
HYDROMETER NUMBER: 15-1515	<u> </u>	<del></del>		#40	ERR	į	<u> </u>	<del></del>	
BEAKER NUMBER: 4	nango.	nim		#60	ERR	1			ł
FLASK NUMBER:	PARI G:	SIEVE OF -#	10	#100	ERR	l	LL:		
SPECIFIC GRAVITY:	1.	CUM	DEDOCUM	#200	ERR		PL:		
PORTION TESTED: -#10	ł	CUM WEIGHT	PERCENT FINER	ERR	ERR		PI:		
MOIST WT. OF SOIL (g): 69. Qu		WEIGHT	FINER	ERR ERR	ERR			<del></del>	
CORRECTED DRY WT (g): ERR	TARE (g)	13661	Ĭ	ERR	ERR .		_		l
Rm:	#20	143.03	ERR	ERR	ERR ERR	İ	D10:	·	
	#40	151.93	ERR	ERR	ERR	ĺ	D30:		i
STANDARD SOLUTION TEMP. READ.	#60	161.00	ERR	ERR	ERR	]	D60: Cu:		ı
ZERO CORRECTION	#100	166.52	ERR	ERR	ERR	} .	Cu:		Į.
THE CORRESPOND	#200	170.29	ERR			ļ	<u> </u>		1
ELAPSED	ZERO	CORR							
TIME TEMP. HYDRO	CORR,	CORR. FACTOR	CORR.	~ ~~~~	EFF.	CONSTANT		· · · · · · · · · · · · · · · · · · ·	
D HR M S (min.) (C) READING	(CONT.)	INCIOR	ACION	% FINER		(T&Gs)	DIAM.	LOG %	TOTAL
	(001.1.)	<del></del>			L,cm	K	(mm)	DIAM S	AMPLE
0 0.0									
0 0 0.0 22.1 31	ERR	ERR	1.5	ERR	16.131	ERR			ĺ
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	ERR	ERR	1.5	ERR	16.131	ERR	ERR ERR	ERR	ERR
<u> </u>	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR
$\frac{1}{\sqrt{7}}$ $\frac{1}{17}$ 0 0.0 21.7 12.5	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR ERR	ERR
$\frac{1}{2}$ $\frac{17}{2}$ 0 0.0 21.6 10 0.0 21.6 10	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR ERR
$\frac{1}{10}$ $\frac{1}{10}$ 0 0.0 $\frac{1}{10}$ $\frac{1}{10}$ 0 0.0 $\frac{1}{10}$ $\frac{1}{10}$ $\frac{1}{10}$ 0 0.0 $\frac{1}{10}$ $\frac{1}{10}$ $\frac{1}{10}$	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR
0.0 19.4 5.5	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR
	<del></del>	<del></del>		· · · · · · · · · · · · · · · · · · ·			******	LINI	LINI
PROJECT: Monsanto/ RT/FS Soctiment	ハラ								
PROJECT NUMBER: 13-101.602	DATE:	i.	10-93			GOL	DER ASSOCIATE	ES INC.	
TECHNICIAN: AF DPO	REVIEW		DO			GEO	TECHNICAL TES	TING LABOR	ATORY
			744			RED	MOND, WASHIN	GTON	-

WORKSHEET FOR H						NATUKALI	MOISTORE	PART C:	-#10 MOIST	URE	PART D: +#1	0 MOISTURE	E
ASTM D-122 (	MODIFIED	FOR TEMP	ERATUR	E CHANGE)	]			·			1		
WORKSHEET FOR DI	RYPREPA	RATION OF S	SOILS		TARE #:			TARE #:			TARE #:		26
ASTM D-421					TARE (g):			TARE (g)	•	39.96	TARE (g):		76.66
WORKSHEET FOR M	OISTURE (	CONTENT OF	SOILS		MOIST W			MOISTW		231.22	MOIST WT. (g	<b>.</b> .	28,60
ASTM D-2216					OVEN DR				(g). {Y WT (g):	228,64	OVEN DRY W		
UPDATED 11/	76/01 BV D	OCTED			W'%:	· · · · (E)·	ERR	W%:	(R).	ERR	W%:	1 (R):	87.79 ERR
PART B: SEPARATIO				<del></del>	1	IEVE OF +		W 70.	<del></del>	T ERR	[ W 70:		EKK
TAKI B: SEPAKATIO	N OF FRAC	TIONS			PARIE: S	IEAE OL +	# 10	F	D C 01 11 000			<del></del>	ı .
l								FINAL	RESULTS		RING:		
WEIGHT TOTAL SAM			(g):	1751 (8			PERCENT	ł		1		SS - 2400	
WEIGHT OF AIR DRY		:		107, 10	i	WEIGHT	FINER	GRAIN	PERCENT	DE	PTH:		
WEIGHT OF -#10 TAF	RE (g):			107.10				SIZE	FINER	}			
WEIGHT OF -#10 FRA	CTION +	TARE (g):			TARE (g)	76,38				1		•	
WEIGHT OF -#10 FRA				0.00	3" "		ERR	3"	ERR	co	LOR:		
WEIGHT OF +#10 FR				0.00	2"		ERR	2"	ERR		(CU 112 1)	ort fru	Ratio
OVEN DRY WEIGHT				ERR	1"	-	ERR	1"	ERR	12	(C)	7. 4. 1 23 7	سيعم
OVEN DRY WEIGHT			I (a).	ERR	3/4"	<del> </del>	ERR	3/4"	ERR		SCRIPTION:		
					1	<b>├</b>		n			<del></del>		
OVEN DRY WEIGHT	OF TOTAL	SAMPLE (g)		ERR	3/8"		ERR	3/8"	ERR		Sylvania in the	**	
					#4	Şυ.	ERR	#4	ERR	1			
PART F: HYDROMET	TER TEST (	on fine fra	CTION		#10	1265ch	ERR	#10	ERR				
							:	#20	ERR	1	USCS:		
HYDROMETER TYPE	E:	152H						#40	ERR	j			
HYDROMETER NUM		15-1515						#60	ERR	)			
BEAKER NUMBER:		(4)			PARTGO	SIEVE OF -#	£10	#100	ERR	1	LL:	<del></del>	
FLASK NUMBER:		}\			17161 0	SIEVE OF -#	10	#200		1	<u> </u>	<del></del>	
		1-3-					252 251	11	ERR		PL:		
SPECIFIC GRAVITY:		<b>—</b>					PERCENT	ERR	ERR		PI:		
PORTION TESTED:		-#10			1	WEIGHT	FINER	ERR	ERR				
MOIST WT. OF SOIL (		(ob.6)			}			ERR	ERR	-1			
CORRECTED DRY W	T (g):	ERR			TARE (g)	727,75%		ERR	ERR		D10:		
Rm:		1			#20	75.96	ERR	ERR	ERR		D30:		
					#40	80.20	ERR	ERR	ERR	Ī	D60:	—	
		TEMP.	READ.		#60	1811 46	ERR	ERR	ERR	1	Cu:		
STANDARD SOLUTION	NC			1	#100	88.51	ERR	ERR	ERR		Cz:		
ZERO CORRECTION	<b>511</b>			ł	#200	43,04	ERR	LIKK	LIKK	1	CZ:	J	
PARTO CONCINE FROM		LL	<del></del>	,	# 200	91 3, 634	j ERK	4		1			
		ELAPSED		<del> </del>	ZERO	CORR.	CORR.	Ų	ECC	L CONSTANT			
			777.4.40	HVDDO				e chico	EFF.	CONSTANT			
	_	TIME	TEMP.		CORR.	FACTOR	FACTOR	% FINER	DEPTH	(T&Gs)	DIAM.	LOG	%TOTAL
D HR M	S	(min.)	(C)	READING	(CONT.)		a		L,cm	K	(mm)	DIAM	SAMPLE
				•		•							
22 10 56	. 0	0.0											
	0	0.0	21.4	740	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR
59	0	0.0	11,15	236	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR
	. 0		11.5	210	ERR		1.5	ERR	16.131	ERR	ERR	ERR	ERR
16.	. 0		21,7	2 27	ERR		1.5	ERR	16.131				
56										ERR	ERR	ERR	ERR
	. 0		220	12	ERR		1.5	ERR	16.131	ERR	ERR	ERR	ERR
— <u>    = = = = = = = = = = = = = = = = = </u>	-, 0	-	22.6	19	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR
1 1 44	/ 0	0.0	<u> 23.3</u>	14	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR
12 50 12 50 12 50 11 21	0	0.0	20.5	12,5	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR
	-										- LINIX	DIVIN	2
		, 1	<del> </del>					<del></del>	· · · · · · · · · · · · · · · ·	<del></del>			
PROJECT:	Morce	anto RT	125	tom from	112			•		~~	N DEB ASSOCIATION	CTO INC	
PROJECT NUMBER:	(1.2.1)	01.603	-1'-		, –		1-10-017	Ł			LDER ASSOCIAT		
TECHNICIAN:	MF/D	0.5			DATE:		<u></u>	•			OTECHNICAL TE		ORATORY
TECHNICIAN:	TYP / V	40			REVIEW	ED BY:	_ <del></del>			RE	DMOND, WASHI	NGTON	
						_					·		

WORKSHEET FOR HYDROM	ETER AND SIEVE									
ASIM (MODIF	IED FOR TEMPERATURE CHANGE	PARTA	NATURA	LMOURE	PARTO	-#10 MOIS	THE			
	PARATION OF SOILS	3)]				· · · · · · · · · · · · · · · · · · ·	I UKE	PARTI	D: +#10 MOISTL	JRE -
ASTM D-421	FARATION OF SOILS	TARE #	:		TARRA	•		1		
WORKSHEET FOR MOVE		TARE (g	<b>)</b> :		TARE #		15-1	TARE #	ÿ:	
WORKSHEET FOR MOISTUR	E CONTENT OF SOILS	MOIST	 MT (~).	<del></del>	TARE	3):	70.06	TARE (		<b>———</b>
V2 TW D-7710		OVEND	7 1. (g);	ļ	MOIST	WT. (g):	12/25	MOIST	5).	
UPDATED 11/26/91 BY	D. OSTER	OVEND	RY WT (g):		OVEND	RY WT (g):	134.77	MOIST	w 1. (g):	
PART B: SEPARATION OF FR	ACTIONS	N'%:		ERR	W%:	(6)		OVEN	DRY WT (g):	
	,	PARTE:	SIEVE OF	+#10			ERR	W%:		ERR
WEIGHT TOTAL SAMPLE + T	14DD 44D	j			EINIA	DD0141	1			
WEIGHT OF AIR DRY TARE	ARE, AIR DRY (g): 3,57,28	ļ	CUM	PERCENT	LINA	RESULTS	ВО	RING:		7
WEIGHT OF AIR DRY TARE	8):	Í	WEIGHT		II .		1 90	MPLE:	MS35-10	55
WEIGHT OF .#10 TARE (g):		1	WEIGH	r finer	GRAIN	PERCENT		PTH:	14/222-10	29
WEIGHT OF -#10 FRACTION	TARE(a).	TABELL		_	SIZE	FINER		• • • • •	L	
MCIUMI OF -#10 FRACTION	AIR DDV (a)	TARE (g)	ˈ <b></b>		J)				•	
I A PIOUT OF +#10 ERYCLUM	AIR DRV (a).	3"	L	ERR	3"	ERR	1			
I O VEN DRY WEIGHT OF FINE	S (a):	2"	L	ERR	2"			.OR:		
OVEN DRY WEIGHT OF COAL	ERR	1"		ERR	l i	ERR	Be	curs >	black 5 yR	
OVEN DRY WEIGHT OF COAL	CSE FRACTION (g): ERR	3/4"		ERR	94	ERR	ļ			الريبية
OVEN DRY WEIGHT OF TOTA	AL SAMPLE (g): ERR	3/8"		<b>⊣</b>	3/4"	ERR	DES	CRIPTION:	<b>!</b>	
DADTE HIME		#4	<del></del>	ERR	3/8"	ERR				
PART F: HYDROMETER TEST	ON FINE FRACTION		<b>}</b>	ERR	#4	ERR	1 1 4	2117		1
		#10	<u></u>	ERR	#10	ERR				
HYDROMETER TYPE:	152H	1			#20	ERR	1			
HYDROMETER NUMBER:	15-1515				#40			USCS:		
BEAKER NUMBER:						ERR				
FLASK NUMBER:	3	PART G: 5	SIEVE OF -	#10	#60	ERR				
SPECIFIC GRAVITY:	7			710	#100	ERR	1	LL:		
MARTINE OKAVITY:			<i>-</i> 1		#200	ERR	1	PL:		
PORTION TESTED:	-#10	*		PERCENT	ERR	ERR	I	PI:	<b></b>	
MOIST WT. OF SOIL (g):	69.06		WEIGHT	FINER	ERR	ERR	l	FI;		
CORRECTED DRY WT (g):	ERR			•	ERR	ERR .				
Rm:		TARE (g)	136.65	l l	ERR	ERR				
	*	#20	137.03	ERR	ERR			D10:		
	[	#40	137.96	ERR		ERR		D30:		•
STANDARD SOLUTION	TEMP. READ.		139.56		ERR	ERR		D60:		
ERO CORRECTION			143.69	ERR	ERR	ERR		Cu:		
asso cossiscitor				ERR	ERR	ERR	•	Cz:	<del></del>	
		#200 [	151.60	ERR				C2. [	J	
····	ELAPSED	7500		I		ſ				į
	TIME TEMP. HYDRO	ZERO	CORR.	CORR.		EFF.	CONSTANT			
D HR M S	IIIDNO	CORR.	<b>FACTOR</b>	<b>FACTOR</b>	% FINER	DEPTU				
	(min.) (C) READING	(CONT.)	t	a		_	(T&Gs)	DIAM.	LOG	%TOTAL
17 9 55 0		-				L _i cm	<u> </u>	(mm)	DIAM	SAMPLE
	0.0						-			WHI LE
— <u>*6</u> 0	0.0 71.5 45	ERR	ERR							j
	0.0 71-8 31.5	ERR		1.5	ERR	16.131	ERR	ERR	<b></b> .	
10 3 0 15 0 55 0 17 55 0 17 55 0 17 55 0	0.0 21.7 25.5		ERR	1.5	ERR	16.131	ERR		ERR	ERR
<u> </u>	0.0 21-6 19	ERR	ERR	1.5	ERR	16.131	ERR	ERR	ERR	ERR
		ERR	ERR	1.5	ERR	16.131		ERR	ERR	ERR
7 77 55	201211212	ERR	ERR	1.5	ERR		ERR	ERR	ERR	ERR
TITE	0.0 21.6 12.5	ERR	ERR	1.5		16.131	ERR	ERR	ERR	ERR
3 A 55	0.0 21.8 9.5	ERR	ERR		ERR	16.131	ERR	ERR		
- 55 0	0.0 19.7 9	ERR		1.5	ERR	16.131	ERR	ERR	ERR	ERR
		CKK	ERR	1.5	ERR	16.131	ERR		ERR	ERR
\.							L-1/1/	ERR	ERR	ERR
ROJECT: Monsa	NO RT FS Seliming /	12					<del></del>			1
TOWNDER: 'II Sall O	1 1 1 1 1 1 200 (M) 1 1	12								
CHNICIAN: MF/DP	1100	DATE:	1 -	10-93			GOLD	ER ASSOCIA	ATES INC	
INF / DV	0	REVIEWE		500			GEOTI	CHNICAL	TESTING LABOR	D 4 TO 5
				<u> </u>			REDM	OND, WASI	TINGTON LABOR	KATORY
•					-			TID, WASI	אטוטאווי	ľ

#### GOLDER ASSOCIATES INC., REDMOND, WA

## SUMMARY OF SPECIFIC GRAVITY AND MOISTURE CONTENT ASTM D-854 AND D-2216

PROJECT:

MONSANTO/RI/FS SEDIMENT/ID

PROJ. NO:

913-1101.603

DATE:

9-8-93

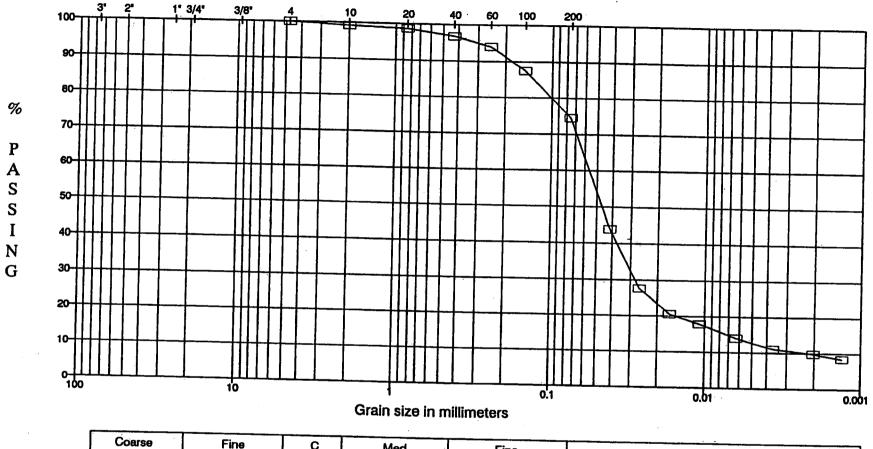
TECH:

MF/CS

**REVIEW:** 

DPO

	SPECIFIC	MOISTURE CONTENT
SAMPLE ID	GRAVITY	(%)
HSS3-100	2.46	210.7
SCSS3-4400	2.95	31.8
SCSS3-6400	2.69	19.2
SCSS3-8400	2.77	22.8
SCSS3-8400 FD	2.77	29.7
SCSS3-10400	2.65	151.4
SCSS3-12400	2.54	270.0
SCSS3-14400	2.68	103.1
SCSS3-15500	2.79	54.1
SWSS3-100	2.66	21.2



Coarse	Fine	С	Med	Fine	
GRA	VEL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
HSS3-100		210.7		12	**		Dusky brown (5YR 2/2),
							CLAYEY SILT, some f sand,
					<u>.                                    </u>		organics present, (ML).

PROJECT:

MONSANTO/ RI/FS SEDIMENT/ ID

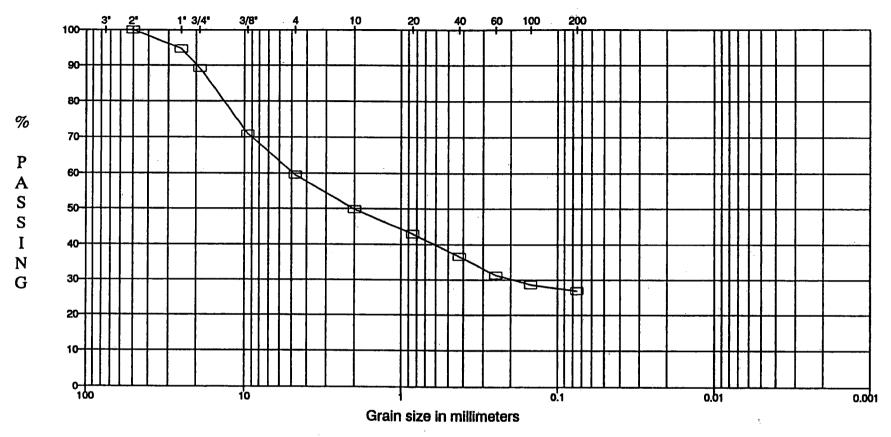
PROJECT NO.: 913-1101.603

DATE: 9-9-93

TECH: MF/TW

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.



Coarse	Fine	С	Med	Fine	
GRA	/EL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
SCSS3-4400		31.8				GM	Dusky yellowish brown (10YR 2/2),
							c-f GRAVEL and c-f SAND,
<u> </u>							some silt, organics present, (GM).

PROJECT:

MONSANTO/ RI/FS SEDIMENT/ ID

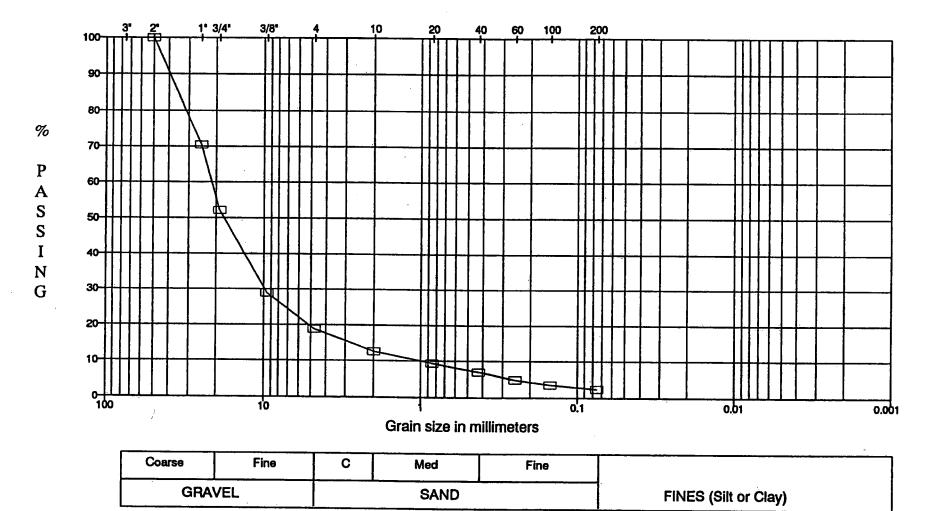
PROJECT NO.: 913-1101.603

DATE: 9-9-93

TECH: CS/MF

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.



SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
SCSS3-6400		19.2		•			Dusky yellowish brown (10YR 2/2), c-f GRAVEL, some c-f sand, trace silt, (GP).

PROJECT:

MONSANTO/ RI/FS SEDIMENT/ ID

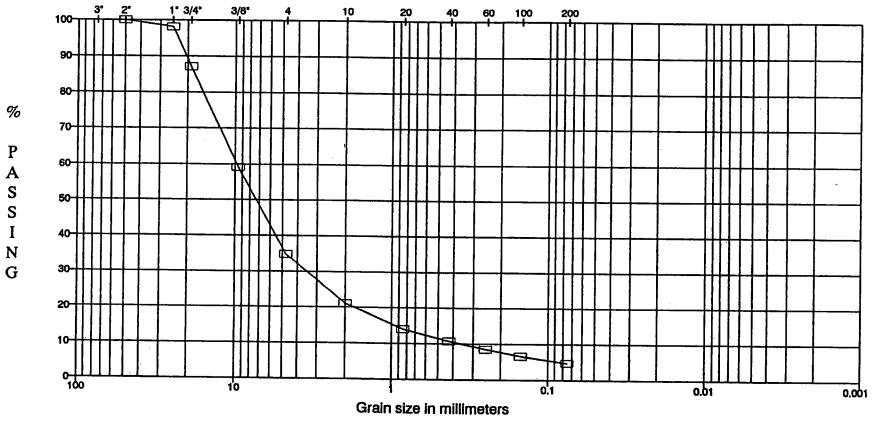
PROJECT NO.: 913-1101.603

DATE: 9-9-93

TECH: CS/MF

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.



Coarse	Fine	С	Med	Fine	
GRA	VEL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
SCSS3-8400		22.8					Dusky yellowish brown (10YR 2/2), c-f GRAVEL and c-f SAND.
						İ	trace silt, organics present, (GP).

PROJECT:

MONSANTO/ RI/FS SEDIMENT/ ID

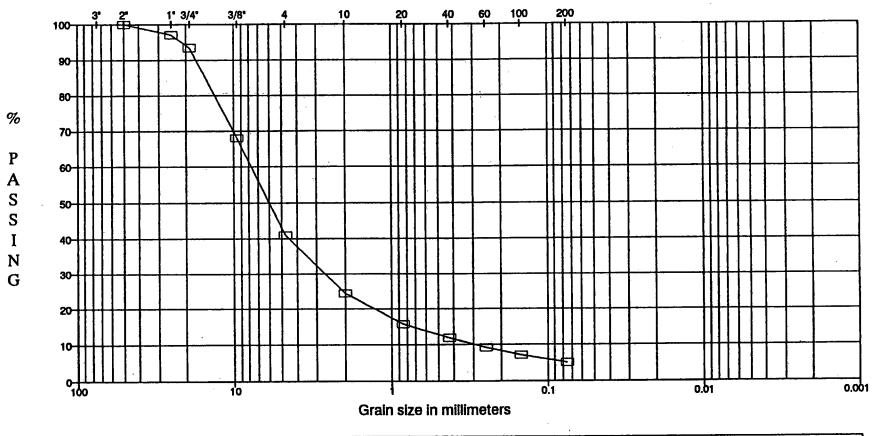
PROJECT NO.: 913-1101.603

DATE: 9-9-93

TECH: CS/MF

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.



Coarse	Fine	С	Med	Fine	
GRA	VEL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
SCSS3-8400FD		29.7				GP-GM	Dusky yellowish brown (10YR 2/2),
							c-f GRAVEL and c-f SAND,
							little silt, organics present, (GP-GM).

PROJECT:

MONSANTO/ RI/FS SEDIMENT/ ID

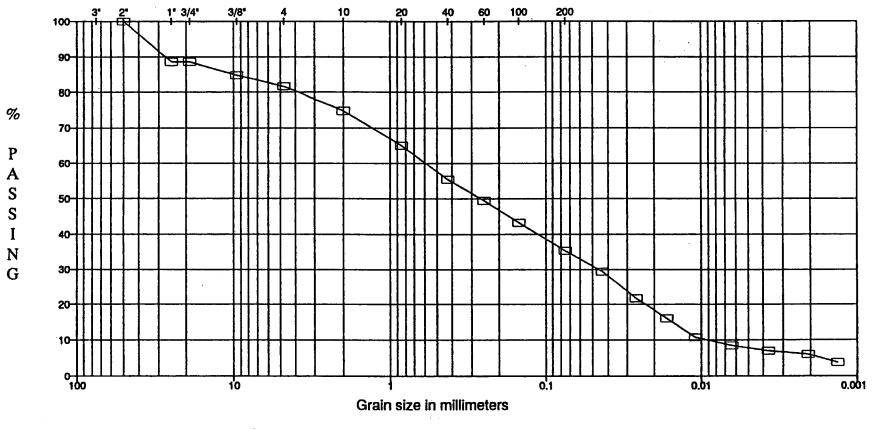
PROJECT NO.: 913-1101.603

DATE: 9-9-93

TECH: CS/MF

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.



Coarse	Fine	С	Med	Fine	
G	RAVEL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PΙ	USCS	DESCRIPTION
SCSS3-10400		151.4				SM	Dusky yellowish brown (10YR 2/2),
:							c-f SAND and CLAYEY SILT, some
							c-f gravel, organics present, (SM).

PROJECT:

MONSANTO/ RI/FS SEDIMENT/ ID

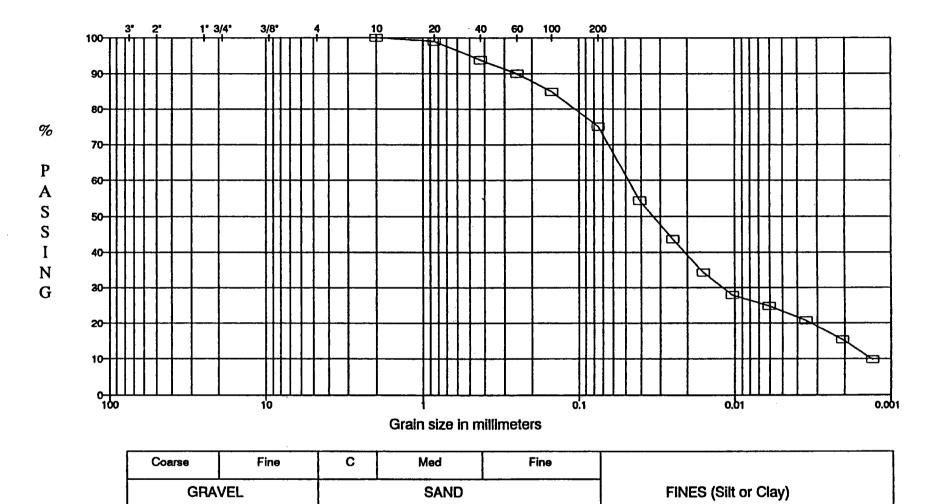
PROJECT NO.: 913-1101.603

DATE: 9-9-93

TECH: CS

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.



SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
SCSS3-12400		270.0				ML	Dusky yellowish brown (10YR 2/2),
							CLAYEY SILT, some m-f sand,
				,			organics present, (ML).

PROJECT:

MONSANTO/ RI/FS SEDIMENT/ ID

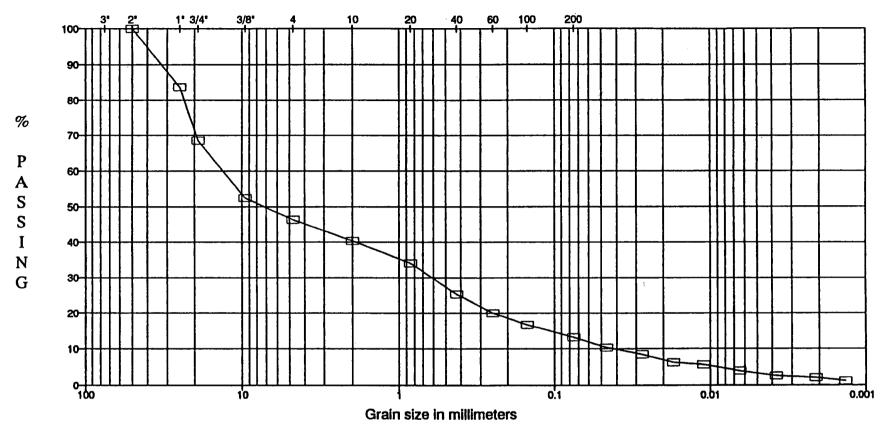
PROJECT NO.: 913-1101.603

DATE: 9-9-93

TECH: CS

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.



Coarse	Fine	С	Med	Fine	
GRA	√EL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
SCSS3-14400		103.1				GM	Dusky yellowish brown (10YR 2/2),
							c-f GRAVEL and c-f SAND, some
							clayey silt, organics present, (GM).

PROJECT:

MONSANTO/ RI/FS SEDIMENT/ ID

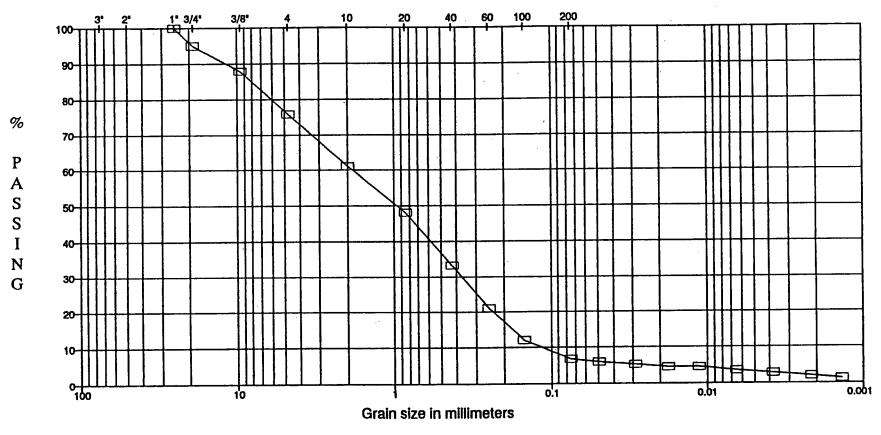
PROJECT NO.: 913-1101.603

DATE: 9-9-93

TECH: MF/TW

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.



Coarse	Fine	С	Med	Fine	
GRA	VEL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
SCSS3-15500		54.1					Dusky yellowish brown (10YR 2/2),
						1	c-f SAND, some c-f gravel, little
							silt, organics present, (SP-SM).

PROJECT:

MONSANTO/ RI/FS SEDIMENT/ ID

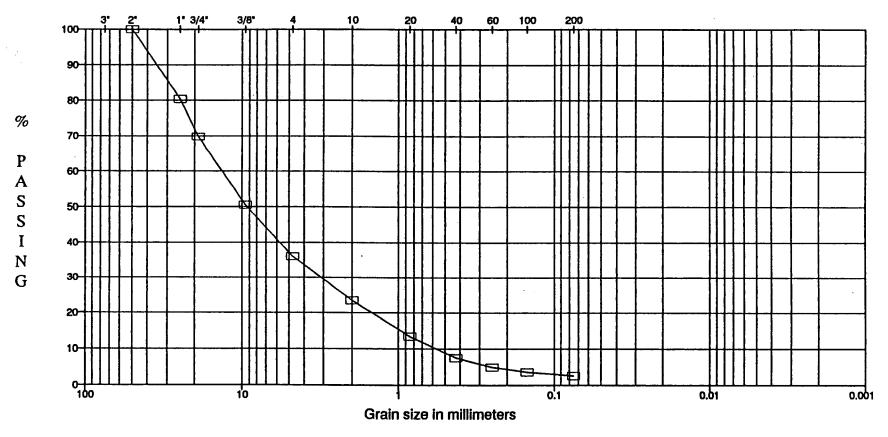
PROJECT NO.: 913-1101.603

DATE: 9-9-93

TECH: MF/TW

**REVIEW: DPO** 

GOLDER ASSOCIATES INC. REDMOND, WA



Coarse	Fine	С	Med	Fine	
GRA	/EL		SAND		FINES (Silt or Clay)

SAMPLE ID	DEPTH	W%	LL	PL	PI	USCS	DESCRIPTION
SWSS3-100		21.2				GW	Dusky yellowish brown (10YR 2/2),
							c-f GRAVEL and c-f SAND,
							trace silt, organics present, (GW).

PROJECT:

MONSANTO/ RI/FS SEDIMENT/ ID

PROJECT NO.: 913-1101.603

DATE: 9-9-93

TECH: CS/MF

**REVIEW: DPO** 

GOLDER ASSOCIATES INC.

WORKSHEET HAYDROMETER AND SIEVE	PART A: NATURAL MOIST	PART C: -#10 MOISTU	PART D: +	#10 MOISTURE
ASTM (MODIFIED FOR TEMPERATURE CHANGE)		<b>'  </b>		
WORKSHEET FOR DRY PREPARATION OF SOILS	TARE #: 39	TARE #:	29 TARE #:	D-5
ASTM D-421	TARE (g): 73.69	TARE (g):	24.71 TARE (g):	91.89
WORKSHEET FOR MOISTURE CONTENT OF SOILS	MOIST WT. (g): 517.95	MOIST WT. (g):	56.51 MOIST WT.	(g): 94.77
ASTM D-2216	OVEN DRY WT (g): 216.69	<b>∢</b>   ₩'' }	55.40 OVEN DRY	
UPDATED 11/26/91 BY D. OSTER	W%: 210.7°	,	3.6% W%:	12.5%
PART B: SEPARATION OF FRACTIONS	PART E: SIEVE OF +#10			
TAKE B. SELAKATION OF TRACTIONS	77.00.00.00.00.00.00.00.00	FINAL RESULTS	BORING:	
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 288.18	CUM PERCEN	1		SS3-100
WEIGHT OF AIR DRY TARE (g): 107.06	WEIGHT FINER	GRAIN PERCENT	DEPTH:	
WEIGHT OF -#10 TARE (g): 107.06	W.D.G.III	SIZE FINER		
WEIGHT OF -#10 FRACTION + TARE (g): 285.30	TARE (g) 91.93	0.22		
WEIGHT OF -#10 FRACTION + TARE (g): 23330 WEIGHT OF -#10 FRACTION, AIR DRY (g): 178.24	3" 91.93 100.0°	3" 100.0%	COLOR:	
(6)	2" 91.93 100.0	1	Dusky brown (5YR	2/2).
	1" 91.93 100.0	· 11	[	<del></del>
	3/4" 91.93 100.0°		DESCRIPTION:	
6,	3/8" 91.93 100.0	1	CLAYEY SILT, son	ne f sand.
OVEN DRY WEIGHT OF TOTAL SAMPLE (g): 174.58	#4 91.93 100.0	11 '	organics present, (M	li li
DARREST AND DATE OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPER	1		organics present, (in	
PART F: HYDROMETER TEST ON FINE FRACTION	#10 93.60 99.0	#10 99.0% #20 98.5%	uscs: [	ML
	[ ·	#20 98.3% #40 96.7%	0363.	
HYDROMETER TYPE: 152H	<del></del>			
HYDROMETER NUMBER: 15-1515	DADEC SELECT OF SIA	11	IL: [	<del></del> 1
BEAKER NUMBER: 3	PART G: SIEVE OF -#10	1	PL:	<del></del>
FLASK NUMBER: 3		#200 74.3%	)	
SPECIFIC GRAVITY: 2.66	CUM PERCEN		PI:	
PORTION TESTED:#10	WEIGHT FINER	0.0262 27.8%		
MOIST WT. OF SOIL (g): 76.95		0.0168 20.7%	510	1
CORRECTED DRY WT (g): 74.26	TARE (g) 73.29	0.0107 18.0%		I/A
Rm: 1	#20 <u>73.68</u> 99.5	li i		<u>//A</u>
	#40 75.06 97.6		<b>1</b>	I/A
TEMP. READ.	#60 77.13 94.8			N/A
STANDARD SOLUTION 18.9 7.0	#100 81.93 88.4		Cz:	N/A
ZERO CORRECTION 25.8 5.0	#200 91.85 75.0	6		
ELAPSED	ZERO CORR. CORR.	EFF.	CONSTANT	
TIME TEMP. HYDRO	CORR. FACTOR FACTOR		(T&Gs) DIAM.	LOG %TOTAL
D HR M S (min.) (C) READING	(CONT.) t a	L,cm	K (mm)	DIAM SAMPLE
31 9 9 0 0.0			_	
31 9 10 0 1.0 23.0 38.0	5.8 0.7 1.		0.01317 0.0414	-1.38 43.8%
31 9 12 0 3.0 23.0 26.0	5.8 0.7 1.		0.01317 0.0262	-1.58 27.8%
31 9 17 0 8.0 22.8 21.0	5.9 0.4 1.		0.01332 0.0168	-1.78 20.7%
31 9 29 0 20.0 22.8 19.0	5.9 0.4 1.	18.2% 13.015	0.01332 0.0107	-1.97 18.0%
31 10 9 0 60.0 22.9 16.0	5.8 0.4 1.		0.01332 0.0063	<b>-2.20</b> 14.1%
31 12 9 0 180.0 22.7 14.0	5.9 0.4 1.	11.4% 13.835	0.01332 0.0037	-2.43 11.3%
31 19 15 0 606.0 22.6 13.0	5.9 0.4 1.		0.01332 0.0020	-2.69 9.9%
32 9 9 0 1440.0 23.0 11.5	5.8 0.7 1.	8.6% 14.245	0.01317 0.0013	-2.88 8.5 <i>%</i>
PROJECT: MONSANTO/ RI/FS SEDIMENT/ ID			GOLDER ASSOCI	ATES INC.
PROJECT NUMBER: 913-1101.603	DATE: 9-9-93	i	GEOTECHNICAL	TESTING LABORATORY
TECHNICIAN: MF/TW	REVIEWED BY: DPO	. , t	REDMOND, WAS	UINCTON

WORKSHEET FOR HYDROMETER AND SIEVE	PART A: NATURAL	MOISTURE	PART C: -#10 M	IOISTURB	PART D: +#	10 MOISTURE
ASTM D-422 (MODIFIED FOR TEMPERATURE CHANGE)						
WORKSHEET FOR DRY PREPARATION OF SOILS	TARE #:	D-12	TARE #:	9	TARE #:	26
ASTM D-421	TARE (g):	96.71	TARE (g):	25.02	TARE (g):	76.29
WORKSHEET FOR MOISTURE CONTENT OF SOILS	MOIST WT. (g):	393.45	MOIST WT. (g):	55.17	MOIST WT.	<del></del>
ASTM D-2216	OVEN DRY WT (g):	214.74	OVEN DRY WT		OVEN DRY V	,
UPDATED 11/26/91 BY D. OSTER	W%:	151.4%	W%:	8.5%	W%:	5.1%
PART B: SEPARATION OF FRACTIONS	PART E: SIEVE OF +			0.570	1	J.1 70
	,		FINAL RESUL	LTS RO	RING:	
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 391.47	CUM	PERCENT			· 1	553-10400
WEIGHT OF AIR DRY TARE (g): 107.07	WEIGHT		GRAIN PERC		PTH:	333-10400
WEIGHT OF -#10 TARE (g): 107.07	WEIGHT	PHILA	SIZE FINE		L	
WEIGHT OF -#10 FRACTION + TARE (g): 286.80	TARE (g) 76.29	1	SIZE FINE	- A		
WEIGHT OF -#10 FRACTION, AIR DRY (g): 230.30	3" 76.29		37 100	\00°	I OB.	
WEIGHT OF +#10 FRACTION, AIR DRY (g): 195.73  WEIGHT OF +#10 FRACTON, AIR DRY (g): 104.67		4	O .	· •	LOR:	(10VD 20)
	<u> </u>	100.0%	1)		sky yellowish brown	1 (10 YR 2/2),
OVEN DRY WEIGHT OF FINES (g): 165.66	1" 106.41	88.6%	11	3.6%		
OVEN DRY WEIGHT OF COARSE FRACTION (g): 99.60	3/4" 106.62	88.6%	N		SCRIPTION:	
OVEN DRY WEIGHT OF TOTAL SAMPLE (g): 265.26	3/8" 116.61	84.8%	N		SAND and CLAYE	•
	#4 124.87	81.7%	II .		gravel, organics pre	sent, (SM).
PART F: HYDROMETER TEST ON FINE FRACTION	#10 143.24	74.8%	#10 74	1.8%		
			II .	5.0%	USCS:	SM
HYDROMETER TYPE: 152H			#40 55	55%		
HYDROMETER NUMBER: 15-1515			#60 49	.4%		
BEAKER NUMBER: 10	PART G: SIEVE OF -	<b>#10</b>	#100 43	3.2%	LL:	
FLASK NUMBER: 5			#200 35	5.5%	PL:	
SPECIFIC GRAVITY: 2.65	CUM	PERCENT	0.0434 29	.4%	PI:	
PORTION TESTED: -#10	WEIGHT	FINER	0.0264 21	.8%	<del></del>	<del></del>
MOIST WT. OF SOIL (g): 74.47			0.0167 16	3%		
CORRECTED DRY WT (g): 68.64	TARE (g) 78.46	}	0.0109 10	0.8%	D10: N/	'A
Rm: 1	#20 87.42		<b>(1</b> )	3.6%	D30: N/	
	#40 96.18	74.2%	III	.1%	D60: N/	
TEMP. READ.	#60 101.76	66.1%	13	5.0%	Cu: N/	
STANDARD SOLUTION 18.9 7.0	#100 107.44	57.8%	II .	3.7%	Cz: N/	
ZERO CORRECTION 25.8 5.0	#200 114.54		0.0015	,	11/	<u>^</u>
	117.57	, 47.470				
ELAPSED	ZERO CORR.	CORR.	EFF	F. CONSTANT		,
TIME TEMP. HYDRO		FACTOR	% FINER DEP		DIAM.	LOG %TOTAL
D HR M S (min.) (C) READING	(CONT.) t	a	Len	` '	(mm)	DIAM SAMPLE
C) READING	(CONT.)	8	LyCi	ц	(mm)	DIAM SAMPLE
31 9 20 0 0.0						
31 9 21 0 1.0 23.4 32.0	67 07	1.0	20.207 10.4	000 0000	0.0404	100 00 100
31 9 23 0 3.0 23.4 25.0	5.7 0.7	1.0	39.3% 10.8		0.0434	-1.36 29.4%
	5.7 0.7	1.0	29.1% 12.0		0.0264	-1.58 21.8%
31 9 28 0 8.0 23.3 20.0	5.7 0.7	1.0	21.8% 12.8		0.0167	-1.78 16.3%
31 9 40 0 20.0 23.2 15.0	5.8 0.7	1.0	14.5% 13.6		0.0109	-1.96 10.8%
31 10 20 0 60.0 23.1 13.0	5.8 0.7	1.0	11.5% 13.9		0.0064	-2.20 8.6%
31 12 20 0 180.0 22.7 12.0	5.9 0.4	1.0	9.5% 14.1		0.0037	-2.43 7.1%
31 19 20 0 600.0 22.6 11.0	5.9 0.4	1.0	8.0% 14.3	327 0.01332	0.0021	-2.69 6.0%
32 9 20 0 1440.0 23.0 8.5	5.8 0.7	1.0	4.9% 14.7	737 0.01317	0.0013	-2.88 3.7%
PROJECT: MONSANTO/ RI/FS SEDIMENT/ ID						
	DATE.	0.0.03			LDER ASSOCIAT	
	DATE:	9-9-93				ESTING LABORATORY
TECHNICIAN: CS	REVIEWED BY:	DPO		RE!	DMOND, WASHI	NOTON

WORKSHEET MAYDROMETER AND SIEVE	PART A: NATURAL M	IOIS E	PART C: -	#10 MOIST	URE	PART D: 4	#10 MOISTURE
ASTM (MODIFIED FOR TEMPERATURE CHANGE)							
WORKSHEET FOR DRY PREPARATION OF SOILS	TARE #:	D-9	TARE #:		T-24	TARE #:	
ASTM D-421	TARE (g):	91.29	TARE (g):		21.00	TARE (g):	0.00
WORKSHEET FOR MOISTURE CONTENT OF SOILS	MOIST WT. (g):	667.01	MOIST WI	ſ. (g):	57.84	MOIST WI	. (g): 0.00
ASTM D-2216	OVEN DRY WT (g):	246.88	OVEN DR	Y WT (g):	54.75	OVEN DR	Y WT (g): 0.00
UPDATED 11/26/91 BY D. OSTER	W%:	270.0%	W%:		9.2%	W%:	0.0%
PART B: SEPARATION OF FRACTIONS	PART E: SIEVE OF +#	10					
			FINAL	RESULTS		ING:	
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 312.38		PERCENT	1			<b>)</b> -	SCSS3-12400
WEIGHT OF AIR DRY TARE (g): 107.12	WEIGHT	FINER	3	PERCENT	DEP	тн: [	
WEIGHT OF -#10 TARE (g): 107.12			SIZE	FINER			
WEIGHT OF -#10 FRACTION + TARE (g): 312.38	TARE (g) 0.00						
WEIGHT OF -#10 FRACTION, AIR DRY (g): 205.26	3" 0.00	100.0%	3"	100.0%	COL		
WEIGHT OF +#10 FRACTON, AIR DRY (g): 0.00	2" 0.00	100.0%	2*	100.0%	Dusk	cy yellowish bro	own (10YR 2/2),
OVEN DRY WEIGHT OF FINES (g): 188.04	1" 0.00	100.0%	1"	100.0%			
OVEN DRY WEIGHT OF COARSE FRACTION (g): 0.00	3/4" 0.00	100.0%	3/4"	100.0%		CRIPTION:	
OVEN DRY WEIGHT OF TOTAL SAMPLE (g): 188.04	3/8" 0.00	100.0%	3/8"	100.0%	CLA	YEY SILT, so	me m-f sand,
	#4 0.00	100.0%	#4	100.0%	orgai	nics present, (N	ML).
PART F: HYDROMETER TEST ON FINE FRACTION	#10 0.00	100.0%	#10	100.0%			
	<del></del>		#20	98.9%	f	USCS:	ML
HYDROMETER TYPE: 152H			#40	93.8%		_	
HYDROMETER NUMBER: 15-1515	<del></del>		#60	89.9%			
BEAKER NUMBER: 18	PART G: SIEVE OF -#	10	#100	84.7%		LL:	
FLASK NUMBER: 9			#200	75.0%	İ	PL:	
SPECIFIC GRAVITY: 2.54	сим	PERCENT	0.0407	54.4%		PI:	
PORTION TESTED: -#10	WEIGHT	FINER	0.0249	43.6%			
MOIST WT. OF SOIL (g): 71.97		THILA	0.0159	34.2%			
CORRECTED DRY WT (g): 65.93	TARE (g) 75.92		0.0104	28.0%		D10:	N/A
Rm: 1	#20 76.62	98.9%	0.0061	24.8%		D30:	N/A
Kill.	#40 79.99	93.8%	0.0036	20.8%	1	D60:	N/A
TEMP. READ.	#60 82.55	89.9%	0.0021	15.5%	}	Cu:	N/A
	1 ———	84.7%	0.0021	9.9%		Cz:	N/A
STANDARD SOLUTION   18.9   7.0	#100 85.98 #200 92.40	75.0%	0.0013	9.970		CZ: L	IVA
ZERO CORRECTION [2.5] 3.0]	7240	13.070					
ELAPSED	ZERO CORR.	CORR.	<u> </u>	EFF.	CONSTANT	a makan ng manaharan pamaya <u>n ang manaharan ka</u>	
TIME TEMP. HYDRO	CORR. FACTOR	<b>FACTOR</b>	% FINER	DEPTH	(T&Gs)	DIAM.	LOG %TOTAL
D HR M S (min.) (C) READING	(CONT.) t	8		L,cm	K	(mm)	DIAM SAMPLE
31 9 53 0 0.0 31 9 54 0 1.0 23.8 40.0	5.6 0.7	1.0	54.4%	9.571	0.01317	0.0407	-1.39 54.4%
31 9 56 0 3.0 23.8 33.0	5.6 0.7	1.0		10.719	0.01317	0.0249	-1.60 43.6%
31 10 1 0 8.0 23.6 27.0	5.6 0.7	1.0	34.2%	11.703	0.01317	0.0249	-1.80 34.2%
31 10 13 0 20.0 23.6 23.0 23.0	5.6 0.7	1.0	28.0%	12.359	0.01317	0.0104	-1.98 28.0%
]	5.7 0.7	1.0	24.8%	12.687	0.01317	0.0061	-2.22 24.8%
· · · · · · · · · · · · · · · · · · ·		1.0	20.8%	13.097	0.01317	0.0036	-2.45 20.8%
		1.0	15.5%	13.589	0.01317	0.0036	-2.68 15.5%
	5.9 0.4 5.8 0.7	1.0	9.9%	14.245	0.01332	0.0021	-2.88 9.9%
32 9 53 0 1440.0 23.0 11.5	J.0 V./	1.0	7.770	17.243	V.V1317	V.VV13	-2.00 7.370
PROJECT: MONSANTO/ RI/FS SEDIMENT/ ID						LDER ASSOC	
PROJECT NUMBER: 913-1101.603		9-9-93					L TESTING LABORATORY
TECHNICIAN: CS	REVIEWED BY:	DPO			REI	DMOND, WAS	HINGTON

WORKSHEET FOR HYDROMETER AND SIEVE	PART A: NATURAL MOISTURE	PART C: -#10 MOISTURE	PART D: +#10 MOISTURE
ASTM D-422 (MODIFIED FOR TEMPERATURE CHANGE)			
WORKSHEET FOR DRY PREPARATION OF SOILS	TARE #: D-13	TARE #: 10	TARE #: 33
ASTM D-421	TARE (g): 90.97	TARE (g): 25.12	TARE (g): 73.70
WORKSHEET FOR MOISTURE CONTENT OF SOILS	MOIST WT. (g): 540.63	MOIST WT. (g): 75.15	MOIST WT. (g): 250.14
ASTM D-2216	OVEN DRY WT (g): 312.33	OVEN DRY WT (g): 71.25	OVEN DRY WT (g): 244.36
UPDATED 11/26/91 BY D. OSTER	W%: 103.1%	W%: 8.5%	W%: 3.4%
PART B: SEPARATION OF FRACTIONS	PART E: SIEVE OF +#10		
		FINAL RESULTS BO	RING:
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 407.50	CUM PERCENT	1	MPLE: SCSS3-14400
WEIGHT OF AIR DRY TARE (g): 107.04	WEIGHT FINER	N 1	PTH:
WEIGHT OF -#10 TARE (g): 107.04	1	SIZE FINER	
WEIGHT OF -#10 FRACTION + TARE (g): 231.06	TARE (g) 73.73		
	3" 73.73 100.0%	3" 100.0% CO	LOR:
	2" 73.73 100.0%	, <u></u>	sky yellowish brown (10YR 2/2),
		1" 83.6%	on Jenowich Count (10 110 412),
OVEN DRY WEIGHT OF FINES (g): 114.35		1	SCRIPTION:
OVEN DRY WEIGHT OF COARSE FRACTION (g): 170.66		li (	GRAVEL and c-f SAND, some
OVEN DRY WEIGHT OF TOTAL SAMPLE (g): 285.01	3/8" 209.15 52.5%		·
	#4 226.84 46.3%		yey silt, organics present, (GM).
PART F: HYDROMETER TEST ON FINE FRACTION	#10 243.48 40.4%		Trace Cold
	1	#20 34.0%	USCS: GM
HYDROMETER TYPE: 152H		#40 25.5%	
HYDROMETER NUMBER: 15-1515		#60 20.0%	
BEAKER NUMBER: 15	PART G: SIEVE OF -#10	#100 16.7%	LL:
FLASK NUMBER: 8		#200 13.4%	PL:
SPECIFIC GRAVITY: 2.68	CUM PERCENT	0.0468 10.4%	PI:
PORTION TESTED: -#10	WEIGHT FINER	0.0276 8.6%	
MOIST WT. OF SOIL (g): 73.72		0.0173 6.2%	
CORRECTED DRY WT (g): 67.97	TARE (g) 74.17	0.0110 5.6%	D10: N/A
Rm: 1	#20 84.95 84.1%	0.0065 3.8%	D30: N/A
	#40 99.32 63.0%	0.0038 2.6%	D60: N/A
TEMP. READ.	#60 108.47 49.5%	0.0021 2.1%	Cu: N/A
STANDARD SOLUTION 18.9 7.0	#100 114.05 41.3%	11 (	Cz: N/A
ZERO CORRECTION 25.8 5.0	#200 119.58 33.2%	11	
ELICO CONTROLLO		<b>I</b>	
ELAPSED	ZERO CORR. CORR.	EFF. CONSTANT	
TIME TEMP. HYDRO	CORR. FACTOR FACTOR	% FINER DEPTH (T&Gs)	DIAM. LOG %TOTAL
D HR M S (min.) (C) READING	(CONT.) t a	L,cm K	(mm) DIAM SAMPLE
D ARC IVE O (MILE) (C) READING			
31 9 31 0 0.0			
31 9 32 0 1.0 22.8 23.0	5.9 0.4 1.0	25.6% 12.359 0.01332	0.0468 -1.33 10.4%
31 9 34 0 3.0 22.8 20.0	5.9 0.4 1.0	21.2% 12.851 0.01332	0.0276 -1.56 8.6%
	5.9 0.4 1.0	15.4% 13.507 0.01332	0.0173 -1.76 6.2%
	5.9 0.4 1.0	13.9% 13.671 0.01332	0.0110 -1.96 5.6%
[			0.0065 -2.19 3.8%
31 10 31 0 60.0 22.7 12.0	5.9 0.4 1.0	9.5% 14.163 0.01332	1
31 12 31 0 180.0 22.6 10.0	5.9 0.4 1.0	6.5% 14.491 0.01332	
31 19 17 0 586.0 22.6 9.0	5.9 0.4 1.0	5.1% 14.655 0.01332	0.0021 -2.68 2.1%
32 9 31 0 1440.0 23.0 7.0	5.8 0.7 1.0	2.8% 14.983 0.01317	0.0013 -2.87 1.1%
DROJECT. MONSANTO/ BIES SEDIN/ENT/ ID			OLDER ASSOCIATES INC.
PROJECT: MONSANTO/ RI/FS SEDIMENT/ ID	DATE: 9-9-93		EOTECHNICAL TESTING LABORATORY
PROJECT NUMBER: 913-1101.603			
TECHNICIAN: MF/TW	REVIEWED BY: DPG	KI	EDMOND, WASHINGTON

ASTM   (MODIFIED FOR TEMPERATURE CHANGE)  WORKSHEET FOR DRY PREPARATION OF SOILS  ASTM D-421  WORKSHEET FOR MOISTURE CONTENT OF SOILS  ASTM D-2216  UPDATED 11/26/91 BY D. OSTER  PART B: SEPARATION OF FRACTIONS  WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g):  WEIGHT OF AIR DRY TARE (g):  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  T-3  TARE #:  TARE #:  T-3  TARE #:  TARE #:  TARE #:  T-3  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  T-3  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  T-3  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  TARE #:  T
ASTM D-421 WORKSHEET FOR MOISTURE CONTENT OF SOILS ASTM D-2216 UPDATED 11/26/91 BY D. OSTER  PART B: SEPARATION OF FRACTIONS  WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): WEIGHT OF AIR DRY TARE (g):  TARE (g): MOIST WT. (g): 569.77 OVEN DRY WT (g): W%: 54.1% W%: FINAL RESULTS WEIGHT FINER  GRAIN PERCENT WEIGHT FINER  TARE (g): MOIST WT. (g): 74.50 OVEN DRY WT (g): 117.69 OVEN DRY WT (g): W%: 3.9%  TARE (g): MOIST WT. (g): 74.50 OVEN DRY WT (g): W%: 3.9%  TARE (g): MOIST WT. (g): FINAL RESULTS SAMPLE: SCSS3-15500 DEPTH:
WORKSHEET FOR MOISTURE CONTENT OF SOILS  ASTM D-2216  UPDATED 11/26/91 BY D. OSTER  PART B: SEPARATION OF FRACTIONS  WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g):  WEIGHT OF AIR DRY TARE (g):  WOIST WT. (g):  OVEN DRY WT (g):  W%:  569.77  OVEN DRY WT (g):  W%:  569.77  OVEN DRY WT (g):  W%:  FINAL RESULTS  SAMPLE:  SCSS3-15500  DEPTH:
ASTM D-2216
UPDATED 11/26/91 BY D. OSTER  W%: 54.1% W%: 6.8% W%: 3.9%  PART B: SEPARATION OF FRACTIONS  PART E: SIEVE OF +#10  WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 338.06  WEIGHT OF AIR DRY TARE (g): 107.12  WEIGHT FINER GRAIN PERCENT  WEIGHT FINER GRAIN PERCENT  DEPTH:
PART B: SEPARATION OF FRACTIONS  PART E: SIEVE OF +#10  FINAL RESULTS  BORING:  SAMPLE: SCSS3-15500  WEIGHT OF AIR DRY TARE (g):  WEIGHT OF AIR DRY TARE (g):  UNDER THE SIEVE OF +#10  FINAL RESULTS  SAMPLE: SCSS3-15500  DEPTH:
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g):  WEIGHT OF AIR DRY TARE (g):  107.12  TINAL RESULTS  BORING:  SAMPLE:  SCSS3-15500  DEPTH:
WEIGHT TOTAL SAMPLE + TARE, AIR DRY (g): 338.06 CUM PERCENT GRAIN PERCENT SAMPLE: SCSS3-15500 DEPTH:
WEIGHT OF AIR DRY TARE (g): 107.12 WEIGHT FINER GRAIN PERCENT DEPTH:
WEIGHT OF MIKE ME.
WEIGHT OF -#10 TARE (g): 107.12 SIZE FINER
WEIGHT OF -#10 FRACTION + TARE (g): 249.36 TARE (g) 93.84
WEIGHT OF -#10 FRACTION, AIR DRY (g): 142.24 3" 93.84 100.0% 3" 100.0% COLOR:
WEIGHT OF +#10 FRACTON, AIR DRY (g): 88.70 2" 93.84 100.0% 2" 100.0% Dusky yellowish brown (10YR 2/2),
OVEN DRY WEIGHT OF FINES (g): 133.18 1" 93.84 100.0% 1" 100.0%
OVEN DRY WEIGHT OF COARSE FRACTION (g): 85.34 3/4" 104.76 95.0% 3/4" 95.0% DESCRIPTION:
OVEN DRY WEIGHT OF TOTAL SAMPLE (g): 218.52 3/8" 120.43 87.8% 3/8" 87.8% c-f SAND, some c-f gravel, little
#4 147.05 75.6% #4 75.6% silt, organics present, (SP-SM).
PART F: HYDROMETER TEST ON FINE FRACTION #10 178.63 61.2% #10 61.2%
#20 48.0% USCS: SP-SM
HYDROMETER TYPE: 152H #40 33.3%
HYDROMETER NUMBER: 15-1515 #60 21.2%
DEARCK HOMBER.
I BASIC NOTICE
STECKTE GRAVIII.
1 01110111011011
7.00
CONTROL WILLIAM AND
TKIII.
#40 108.50 54.4% 0.0038 2.8% D60: 1.9
TEMP. READ. #60 123.22 34.7% 0.0021 2.0% Cu: 15.8
STANDARD SOLUTION 18.9 7.0 #100 134.29 19.8% 0.0014 1.2% Cz: 0.6
ZERO CORRECTION 25.8 5.0 #200 140.69 11.2%
ELAPSED ZERO CORR. CORR. EFF. CONSTANT
TIME TEMP. HYDRO CORR. FACTOR FACTOR % FINER DEPTH (T&Gs) DIAM. LOG %TOTAL
D HR M S (min.) (C) READING (CONT.) t a L,cm K (mm) DIAM SAMPLE
31 9 42 0 0.0
31 9 43 0 1.0 22.9 13.0 5.8 0.4 1.0 9.9% 13.999 0.01332 0.0498 -1.30 6.0%
31 9 45 0 3.0 22.9 12.0 5.8 0.4 1.0 8.6% 14.163 0.01332 0.0289 -1.54 5.2%
31 9 50 0 8.0 22.8 11.0 5.9 0.4 1.0 7.2% 14.327 0.01332 0.0178 -1.75 4.4%
31 10 2 0 20.0 22.9 11.0 5.8 0.4 1.0 7.3% 14.327 0.01332 0.0113 -1.95 4.4%
31 10 42 0 60.0 22.7 10.0 5.9 0.4 1.0 5.9% 14.491 0.01332 0.0065 -2.18 3.6%
31 12 42 0 180.0 22.6 9.0 5.9 0.4 1.0 4.5% 14.655 0.01332 0.0038 -2.42 2.8%
31 19 17 0 575.0 22.6 8.0 5.9 0.4 1.0 3.2% 14.819 0.01332 0.0021 -2.67 2.0%
32 9 42 0 1440.0 22.9 7.0 5.8 0.4 1.0 2.0% 14.983 0.01332 0.0014 -2.87 1.2%
PROJECT: MONSANTO/RI/FS SEDIMENT/ID GOLDER ASSOCIATES INC.
PROJECT NUMBER: 913-1101.603 DATE: 9-9-93 GEOTECHNICAL TESTING LABORATOR
TECHNICIAN: MF/TW REVIEWED BY: DPO REDMOND, WASHINGTON

#### ASTM GRAIN SIZE ANALYSIS MECHANICAL SIEVE ASTM D-1140, C-136 D-2216

PROJECT TITLE:	MONSANI	MONSANTO/ RI/FS SEDIMENT/ ID						
PROJECT NUMBER:	913-1101.60	3		Sample No.:	SCSS3-4400			
				Depth:			•	
WATER CONTENT (Delivered Moisture)								
tare no.			89					
wt soil & tare, moist		ļ	3142.8					
wt soil & tare,dry		ļ	2487.6					
wt tare			429.08					
wt moisture			655.2					
wt dry soil			2058.52					
% water			31.8%					
		<del> </del>						
SIEV	E wt ret	% PASSING	SIEVE					
Si	ze (cumulative)		Size					
taı	e 253.12							
	3" 253.12	100.0%	3"					
	2" 253.12	100.0%	2"					
	1" 364.30	94.6%	1*					
3,	4" 475.38	89.2%	3/4"					
3,	/8" 852.C	70.9%	3/8*					
· •	<b>#4</b> 1084.7	59.6%	#4					
#	10 1288.3	49.7%	#10					
#	20 1427.8	42.9%	#20	D10:	N/A			
#	40 1553.7	36.8%	#40	D30:	N/A			
#	60 1663.8	31.5%	#60	D60:	N/A			
#1	00 1722.2	28.6%	#100	Cu:	N/A			
#2	00 1757.5	26.9%	#200	Cz	N/A			
		<del> </del>						
% C GRVL	10.8	<b>%</b>	Sample:	SCSS3-4400	٦	LL		
% F GRVL	29.6	······································	- <b>T</b>			PL		
% C SAND	9.9	==				PI		
% M SAND	12.9	<b>⊣</b>			_			
% FSAND	9.9	<b>⊣</b>	Wet Color:	Dusky yellowish brown (10	YR 2/2),			
% FINES				c-f GRAVEL and c-f SAND,				
% TOTAL	100			some silt, organics present,				
,		_					·	
			USCS:	GM		TECH	CS/MF	
						DATE	9-9-93	
						REVIEWED	DPO	

**GOLDER ASSOCIATES** 

## **ASTM GRAIN SIZE ANALYSIS MECHANICAL SIEVE**

		ASTM D	-1140, C-13	36 D-2216			
ROJECT TITLE:	MONSANTO	D/ RI/FS SEDI	MENT/ID	Boring No.:			
PROJECT NUMBER:	913-1101.603	<i>3</i> / 10/10 0222	122111722	Sample No.:	SCSS3-6400		
1109201 11011221	713 11011003			Depth:			
				- 1 <b>,</b> 1-1			
WATER CONTENT (De	livered Moistur	e)					
are no.			P-3				
wt soil & tare,moist			2318.70	]			
wt soil & tare,dry			1959.50				
wt tare			90.86				
wt moisture			359.20				
wt dry soil	•		1868.64				
% water			19.2%				
							·
SIEVE	wt ret	% PASSING	SIEVE				
Size	_ <del>``</del>		Size				
tare							
3	<del></del>	100.0%					
2	253.05	100.0%	2*				
1	* 807.8	70.3%	. 1*				
3/4	1147.1	52.2%	3/4"				
3/8	1582.7	28.8%	3/8"				
#-	4 1769.4	18.9%	#4				
#1	1881.4	12.9%	#10				
#2	0 1944.5	9.5%	#20	D10:	0.85		
#4	1991.6	7.0%	#40	D30:	9,9		
#6	2030.2	4.9%	#60	D60:	22.0		
#10	2055.1	3.6%	#100	Cu:	25.9		
#20	2077.5	2.4%	#200	Cz:	5.2		
	· · · · · ·			•	<del></del>		
					_	_	
% C GRVL	47.8%		Sample:	SCSS3-6400		LL [	
% F GRVL	33.3%					PL	
% C SAND	6.0%					PI [	
% M SAND	5.9%				<del>_</del>		
% F SAND	4.6%		Wet Color:	Dusky yellowish brown (10	YR 2/2),		

USCS:

GP

Description: c-f GRAVEL, some c-f sand,

trace silt, (GP).

TECH CS/MF DATE | 9-9-93

REVIEWED DPO

**GOLDER ASSOCIATES** 

% FINES

% TOTAL

2.4%

100%

REDMOND, WA

### ASTM GRAIN SIZE ANALYSIS MECHANICAL SIEVE ASTM D-1140, C-136 D-2216

PROJECT TITLE:		/ RI/FS SEDI	MENT/ID	Boring No.:			
PROJECT NUMBER:	913-1101.603			Sample No.:	SCSS3-8400		
				Depth:			
WATER CONTENT (Deli	vered Moisture	•		· · · · · · · · · · · · · · · · · · ·	•		
tare no.			90				
wt soil & tare,moist			2708.4				
wt soil & tare,dry			2284.0				
wt tare			426.49				
wt moisture			424.4				
wt dry soil			1857.51				
% water		!	22.8%				
SIEVE	wt ret	% PASSING	SIEVE				
Size	(cumulative)		Size				
tare	253.12						
3"	253.12	100.0%		٠			
2*	253.12	100.0%					
1°	290.29	98.0%		•			
3/4"	492.26	87.1%					
3/8"	1010.5	59.2%					
#4	1463.6	34.8%					
#10	)	21.3%					
#20	1847.5	14.2%		D10:	0.35		
#40	<del></del>	10.8%		D30:	3.6		
#60		8.5%		D60:	9.5		
#100		6.7%		Cu:	27.1		
#200	2023.4	4.7%	#200	Cz:	3.9		
						· · · · · · · · · · · · · · · · · · ·	
					٦		
% C GRVL	12.9%		Sample:	SCSS3-8400		IL	
% F GRVL	52.3%					PL	
% C SAND	13.6%			L		PI	L
% M SAND	10.5%			<u> </u>			1
% F SAND	6.1%			Dusky yellowish brown (10			
% FINES	4.7%		Description:	c-f GRAVEL and c-f SAN			
% TOTAL	100%			trace silt, organics present,	(GP).		]
			USCS:	GP			CS/MF
						DATE	
						REVIEWED	DPO

**GOLDER ASSOCIATES** 

REDMOND, WA

### **ASTM GRAIN SIZE ANALYSIS MECHANICAL SIEVE** ASTM D-1140, C-136 D-2216

ROJECT TITLE: ROJECT NUMBER:	MONSANTO 913-1101.603	O/ RI/FS SEDIM	MENT/ID	Boring No.: Sample No.	<del></del>		
	<u></u>			Depth:			
WATER CONTENT (De	livered Moistu	re)					
are no.			85				
vt soil & tare,moist			2755.2				
vt soil & tare,dry			2222.5				
vt tare			426.65				
vt moisture		[	532.7				
vt dry soil			1795.85				
% water			29.7%				
SIEVE	wt ret	% PASSING	SIEVE				
Size	(cumulative)		Size				
tare							
3'	253.13	100.0%	3*				
2	253.13	100.0%	2"				
1	308.15	96.9%	1"	•			
3/4	371.07	93.4%	3/4"				
3/8	827.3	68.0%	3/8"				
#4	1312.8	41.0%	#4				
#10	1609.4	24.5%	#10				
#2	1763.8	15.9%	#20	D10:	0.28		
#4	1834.9	11.9%	#40	D30:	2.8		
#60		9.2%	#60	D60:	7.9		
#100	1919.5	7.2%	#100	Cu:	28.2		
#200	1957.0	5.1%	#200	Cz:	3.5		
		· · · · · · · · · · · · · · · · · · ·				<del></del>	
6 C GRVL	6.6%		Sample:	SCSS3-8400FD		ц	
6 F GRVL	52.4%					PL _	
6 C SAND	16.5%					PI	
6 M SAND	12.6%						
F SAND	6.8%		Wet Color:	Dusky yellowish brown (	10YR 2/2),		
FINES	5.1%		Description:	c-f GRAVEL and c-f SA	ND,		
TOTAL	100%		-	little silt, organics present			

USCS:

GP-GM

TECH CS/MF

DATE 9-9-93

REVIEWED DPO

**GOLDER ASSOCIATES** 

REDMOND, WA

### ASTM GRAIN SIZE ANALYSIS MECHANICAL SIEVE ASTM D-1140, C-136 D-2216

PROJECT TITLE:	MONSANTO	/ RI/FS SEDIM	ŒNT/ID	Boring	No.:			
PROJECT NUMBER:	913-1101.603			Sample	No.:	SWSS3-100		-
				Depth:				
WATER CONTENT (Deliv	ered Moisture	) _				· · · · · · · · · · · · · · · · · · ·		
tare no.			86					
wt soil & tare, moist			2584.5					
wt soil & tare,dry			2206.3					
wt tare			424.77					
wt moisture			378.2					
wt dry soil			1781.53	•				
% water			21.2%					
						<u></u>		
		,						
SIEVE	wt ret	% PASSING	SIEVE					
Size	(cumulative)		Size					
tare	253.11							
3*	253.11	100.0%	3*					
2*	253.11	100.0%	2*					
1*	605.27	80.2%	1°					
3/4"	792.39	69.7%	3/4"					_
3/8*	1133.9	50.6%	3/8"					
#4	1393.9	36.0%	#4					
#10	1616.2	23.5%	#10					
#20	1793.1	13.6%	#20	<b>D</b> 1		0.59		
#40	1900.7	7.5%	#40	D3		3.2		
#60	1947.8	4.9%	#60	De		14.0		
#100	1971.0	3.6%	#100	C		23.7		
#200	1989.4	2.5%	#200	C	Z	1.2		
		<del></del>	F-7-2-3-00-24-0					
~				011/000		ר	<b>-</b> -	
% C GRVL	30.3%		Sample:	SWSS3-100		ľ	LL	
% F GRVL	33.8%						PL	
% C SAND	12.5%					J	PI	<u>L</u>
% M SAND	16.0%						<del> </del>	1
% F SAND	5.0%			Dusky yellowish brow	-	·		
% FINES	2.5%		Description:	c-f GRAVEL and c-f		-		
% TOTAL	100%			trace silt, organics pre	sent, (	GW).		j
								<u></u>
			USCS:	GW				CS/MF
								9-9-93
							REVIEWED	DPO
GOLDER ASSOCIAT	ES			REDMOND, WA				

# SAMPLE 4553 -100

Pycnometer number	40213	
Temperature at weighings ( ^O C)	21.60° 70.00°	
Weight flask + soil + water (Wb)	696.18	
Weight flask + water (Wa)	656.52	
(Wa - Wb)	-39.66	
Evaporating dish number	29	
Weight dish + dry soil	173.64	
Weight dish	104,79	
Weight dry soil (Wo)	. 66.85	
Temperature factor (K)	gaan	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \cdot K = 7.416$$

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project Minson to 121/FG Sed-Nent 110
Project No. 013 - 11011 103 Date 723-93 Tested By CS/MF Approved By DELO



### SAMPLE SC553 -4400

		<del></del>	<del></del>	
Pycnometer number	10213			
Temperature at weighings ( ^O C)	77.0 71.6			
Weight flask + soil + water (W _b )	705,81			
Weight flask + water (Wa)	656.48	**:		
(Wa - Wb)	- 4a.33			
Evaporating dish number	14		·	
Weight dish + dry soil	180.73			
Weight dish	106,08			
Weight dry soil (Wo)	. 74.65			
Temperature factor (K)	19996		·	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_2 - W_0)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \cdot K = 2.0.5$$

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 913-1101 103 Date 8-23-63

Tested By SINE Approved By



## SAMPLE 50593-6400

Pycnometer number	L0213
Temperature at weighings ( ^O C)	22.3
Weight flask + soil + water (Wb)	707.56
Weight flask + water (Wa)	65644
(Wa - Wb)	-51.12
Evaporating dish number	30
Weight dish + dry soil	192,65
Weight dish	111,33
Weight dry soil (Wo)	81.32
Temperature factor (K)	1,22,25

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_2 - W_0)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \cdot K$$
 2.69

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project NO. 413-1161. 103 Date 7.1.4. Tested By C. M. Approved By DO CO



# SAMPLE SCSS3 -8400

Pycnometer number	L0213	
Temperature at weighings (OC)	23.1 79.5	
Weight flask + soil + water (W _b )	702.17	
Weight flask + water (Wa)	65636	
(Wa - Wb)	-45.81	
Evaporating dish number		•
Weight dish + dry soil	171.35	
Weight dish	107.05	
Weight dry soil (Wo)	71.70	
Temperature factor (K)	9993	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_2 - W_b)}$$

$$G_{S/20^{\circ}C} = \frac{W_0}{W_0 + (W_a - W_0)} \cdot K = 2.77$$

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

### SAMPLE SCSS3-8100 FD

Pycnometer number	L021>	
Temperature at weighings ( ^O C)	72.0 22.2	
Weight flask + soil + water (W _b )	698.95	
Weight flask + water (Wa)	656.45	
(Wa - Wb)	_42.50	
Evaporating dish number	25	•
Weight dish + dry soil	172.29	
Weight dish	105.76	
Weight dry soil (Wo)	66.53	
Temperature factor (K)	, 0,096	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_2 - W_0)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{2} - W_{0})} \cdot K = 2.77$$

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project No. 917-1121 1007 Date 5-73-93 Tested By (5 MS Approved By



### SAMPLE SCS53-10400

Pycnometer number	L02(3
Temperature at weighings ( ^O C)	71.9 F° 22.1 C3
Weight flask + soil + water (W _b )	690.83
Weight flask + water (Wa)	656.47
(Wa - Wb)	-34.36
Evaporating dish number	30
Weight dish + dry soil	166.61
Weight dish	111.40
Weight dry soll (W ₀ )	55,21
Temperature factor (K)	,9496

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_2 - W_2)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \cdot K = 2.65$$

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Projed No. Clix - 1101 1173 Date X-23-93

__ Tested By ____C SIMF_ Approved By _

@ Golder Associates

# SAMPLE SCS53-12400

Pycnometer number	60213	
Temperature at weighings ( ^O C)	21.9	-
Weight flask + soil + water (W _b )	694.74	
Weight flask + water (Wa)	65649	
(Wa - Wb)	-38.25	
Evaporating dish number	28	•
Weight dish + dry soll	166.16	
Weight dish	103,01	
Weight dry soil (Wo)	63,16	
Temperature factor (K)	,9996	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \cdot K = 2.54$$

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project Mans 2 113 1 /KI /FC Sod in first 110
Project No. 913-1121 103 Date 9-23-43 Tested By CS ME Approved By WO @ Golder Associates

## SAMPLE 5553 - 144 00

Pycnometer number	L0213	
Temperature at weighings ( ^O C)	72.5	
Weight flask + soil + water (W _b )	701.25	
Weight flask + water (Wa)	65642	
(Wa - Wb)	- 44.83	
Evaporating dish number	26	·
Weight dish + dry soil	178.42	
Weight dish	106.97	
Weight dry soil (Wo)	71.45	
Temperature factor (K)	. 9995	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_2 - W_0)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \cdot K = 2.68$$

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

### SAMPLE SC\$53-15500

Pycnometer number	10213	
Temperature at weighings (OC)	21.9	<u> </u>
Weight flask + soil + water (W _b )	697.80	
Weight flask + water (Wa)	656.49	
(Wa - Wb)	-41.31	
Evaporating dish number	27	•
Weight dish + dry soil	168.21	
Weight dish	103.83	• , 4:
Weight dry soil (Wo)	6438	
Temperature factor (K)	.9996	

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_2 - W_0)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{2} \cdot W_{0})} \cdot K = 2.79$$

Comments:

# Figure SPECIFIC GRAVITY DETERMINATION, ASTM D854

Project Monsanto /K) /FS Sad: ment / 177

Project No. 919-1101 1023 Date 5-23-95 Tested By CS/MF Approved By



## SAMPLE SWSS3 - 100

Pycnometer number	LD2(3)
Temperature at weighings ( ^O C)	27.0
Weight flask + soil + water (W _b )	695.45
Weight flask + water (Wa)	656.48
(Wa - Wb)	-38.97
Evaporating dish number	L/ .
Weight dish + dry soil	169.08
Weight dish	106.66
Weight dry soil (Wo)	62,42
Temperature factor (K)	. 0996

Gs/control temperature = 
$$\frac{W_0}{W_0 + (W_a - W_b)}$$

$$G_{S}/20^{\circ}C = \frac{W_{0}}{W_{0} + (W_{a} - W_{b})} \cdot K = 2.66$$

Comments:

### **Figure** SPECIFIC GRAVITY DETERMINATION, ASTM D854



# APPENDIX G EFFLUENT, SURFACE WATER, AND SEDIMENT CHEMICAL PROPERTIES

# APPENDIX G-1 EFFLUENT AND SURFACE WATER ANALYTICAL RESULTS

TABLE G-1

CHEMICAL ANALYTICAL RESULTS FOR INORGANIC COMPOUNDS IN EFFLUENT AND SURFACE WATER, MONSANTO PHASE I RIFE

SAMPLE SAMPLE SAMPLE NUMBER DATE LOCATION	ALUMINUM ALUMINUM	ARSENIC		BERYLLIUM		ATER, MONS	ANTO	PHASE I RIVES	3		<b>.</b>
EFFLUENT A  EFFLUENT B  EFFLUENT B  10/25/91  EFFLUENT C  10/25/91  EFFLUENT  DOWN A  10/25/91  DOWN B  10/25/91  DOWN C  10/25/91  IRRIG.CANAL  IRRIG.CANAL  IRRIG.CANAL  IRRIG.CANAL  IRRIG.CANAL  IRRIG.CANAL  IRRIG.CANAL  IRRIG.CANAL  SODA CREEK  UP MIDDLE  10/25/91  SODA CREEK	7429-90-5 QUAI (mg/L)  0.08 U 0.07 U 0.11 0.09 0.11 0.09 0.11 0.09 0.11 0.07 U	7440-38-2 (mg/L) 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002	QUAL UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU	7440-41-7 (mg/L) 0.001 0.001 0.001 0.001 0.001 0.001 0.001	CADMIUM 7440-43-8 (mg/L) 0.011 0.009 0.011 0.005 0.005 0.005 0.005 0.005	 CALCIUM 7440-70-2 (mg/L) 130 138 128 88.4 83.7 86.2 84.6 79.8 77.6	QUAL	CHROMIUM 7440-47-3 (mg/L) 0.01 0.01 0.01 0.01 0.01 0.01 0.01	1	COPPER 7440-50-8 (mg/L) 0.007 0.008 0.008 0.005 0.005 0.005 0.005	

TABLE G-1 (Cont'd.)

CHEMICAL ANALYTICAL RESULTS FOR INORGANIC COMPOUNDS IN EFFLUENT AND SURFACE WATER, MONSANTO PHASE I RIFE

SAMPLE NUMBER EFFLUENT A EFFLUENT C DOWN A DOWN B	SAMPLE DATE 10/25/91 10/25/91 10/25/91 10/25/91 10/25/91	IRON 7439-89-8 (mg/L) 0.051 0.048 0.040 0.54	QUAL U U U U	(mg/L) 0.001 0.001 0.001 0.001	ON CO CO CO CO CO CO CO CO CO CO CO CO CO	MAGNESIUM 7439-95-4 (mg/L) 61.4 65.0 60.3 78.5 75.0	MANGANESE 7439-96-5 (mg/L) 0.005 0.005 0.005 0.08	(mg/L) 0.02 0.02 0.02 0.02	0000	(mg/L) 7.3 7.8 7.3 9.3	 SELENIUM 7782-49-2 (mg/L) 0.003 0.003 0.003 0.003	QUA
JP NEAR JP MIDDLE	10/25/91 10/25/91 10/25/91 10/25/91	0.59 0.93 0.47 0.43	ט ט	0.002 0.001 0.001 0.001	22 23	78.7 84.1 78.4 75.5	0.083 0.083 0.082 0.058	0.02 0.02 0.02 0.02	טטט	9.6 10.0 10.4 9.9	0.003 0.003 0.003	UUU

TABLE G-1 (Cont'd.)

## CHEMICAL ANALYTICAL RESULTS FOR INORGANIC COMPOUNDS IN EFFLUENT AND SURFACE WATER HASE I RIVES

SAMPLE NUMBER	SAMPLE DATE	SILVER 7440-22-4 (mg/L)	QUAL		QUAL	VANADIUM 7440-62-2	QUAL	ZINC 7440-68-6	QUA
EFFLUENT A	10/25/91	0.01	اسا	(mg/L)		(mg/L)		(mg/L)	190%
EFFLUENT B EFFLUENT C	10/25/91	0.01	U	105 113		0.12	U	0.025	U
DOWN A	10/25/91	0.01	U	104		0.12	U	0.037	U
DOWN B	10/25/91 10/25/91	0.01	U	31.2		0.21 0.03		0.031	U
DOWN C	10/25/91	0.01	U	29.9	- 1	0.03	U	0.012	U
JP NEAR	10/25/91	0.01 0.01	Ü	31.1	- 1	0.03	ŭ	0.015 0.008	U
IP MIDDLE	10/25/91	0.01	ü	22.0	- 1	0.01	U	0.008	U
P FAR	10/25/91	0.01	ŭ	21.2	ł	0.01	U	0.010	u

U W

NOT DETECTED, VALUE REPORTED IS THE SQL NOT DETECTED, DETECTION LIMIT ESTIMATED DUE TO DEFICIENCY IN QC

TABLE G-2

CHEMICAL ANALYTICAL RESULTS FOR PHYSICAL PARAMETERS IN EFFLUENT AND SURFACE WATER SAMPLES, MONSANTO PHASE I RIFS

SAMPLE NUMBER EFFLUENT A	SAMPLE DATE		(std units)	QUAL	SPECIFIC CONDUCTANCE (//mhos/cm²)	QUAL	TOTAL DISSOLVED SOLIDS (mg/L)	4 1	AMMON- IUM as N (mg/L)	QUAL	BICARB- ONATE	QUAL	CARBO- NATE	QUAL		QUAL
EFFLUENT B	10/25/91	EFFLUENT EFFLUENT	8.0 8.0	J	1390 1430		814 788		0.1	U	(mg/L) 651		(mg/L) 0		(mg/L) 159	<del> </del>
EFFLUENT C DOWN A	1	EFFLUENT IRRIG.CANAL	8.0 7.1	J	1430 1020		786		0.1	U	533 533		. 0		149 153	
DOWN C		IRRIG.CANAL	7.0 7.0	J	1030		556 580		0.12 0.12	U	611 636	;	0		29 30	
JP NEAR JP MIDDLE	10/25/91	SODA CREEK SODA CREEK	6.8		1020 990		546 548		0.43 0.13	U	576 648		0		25 15	
JP FAR		SODA CREEK	7.1 7.1	J	950 933		498 502		0.37 0.10	U	811 817		0		15 15 13	

TABLE G-2 (Cont'd.)

CHEMICAL ANALYTICAL RESULTS FOR PHYSICAL PARAMETERS IN EFFLUENT AND SURFACE WATER SAMPLES, MONSANTO PHASE I RVFS

SAMPLE NUMBER	SAMPLE DATE	FLUOR- IDE (mg/L)	QUAL	HYDRO- XIDE (mg/L)	QUAL	NITRATE/ NITRITE (mg/L)		1	QUAL	TOTAL PHOSPH	QUAI
EFFLUENT A	10/25/91	0.43		0		4.70	<del> </del>	(mg/L)		(mg/L)	<u>L</u> _
EFFLUENT B	10/25/91	0.42		o				96		1.06	
FFLUENTC	10/25/91	0.4		o		4.8		96		1.08	
DOWN A	10/25/91	0.31		ŏ		4.55		96		1.08	ľ
DOMN B	10/25/91	0.34		ő		1.16		42	i	0.21	lυ
DOMN C	10/25/91	0.34	- 1		· [	1.14	1	42		0.24	lυ
IP NEAR	10/25/91	0.31	1	2	1	1.14		42		0.22	ľū
IP MIDDLE	10/25/91	0.31	- 1	0	ı	0.85		30		0.13	Ū
IP FAR	10/25/91	0.31	ĺ	0		0.74	J	30		0.13	Ŭ

J ESTIMATED VALUE
U NOT DETECTED VA

NOT DETECTED, VALUE REPORTED IS THE SQL

# APPENDIX G-2 SEDIMENT ANALYTICAL RESULTS







### CHEMICAL ANALYTICAL RESULTS FOR INORGANIC PARAMETERS IN STREAM SEDIMENTS, MONSANTO PHASE II RI/FS

LOCATION	DATE	ALUM 7429-		ARS 7440	ENIC -38-2		LLIUM -41-7	CADN 7440-		CHRO 7440		COPF 7440-	
		mg/kg	QUAL	mg/kg	QUAL	mg/kg	QUAL	mg/kg	QUAL	mg/kg	QUAL	mg/kg	QUAL
HSS3 100	27-Jul-93			1.7	J			0.9	υ			19	
MSSS 100	12-Dec-92	2020		2.8	J	0.75	υ	41.8		5.7	1	42.4	
SCSS 100 UP	27-Jul-93												l
SCSS 600	03-Dec-92			5.3				14.4	J		1	4	
SCSS 700	04-Dec-92			11.6	Ì	·		8.6	J		ļ	8.4	
SCSS 900	04-Dec-92			29.2		!		8.9	J			8.4	i
SCSS 1200	04-Dec-92			18.7				27.7	J	1		10.1	
SCSS 2400	03-Dec-92			49.3		•		55.7	J			18.5	İ
SCSS 4400	27-Jul-93			31.4	J			20		ł		15.9	l
SCSS 6400	27-Jul-93	[		44.4	J	1		16.8		j	1	43	}
SCSS 8400	27-Jul-93	•		32.5	J			17.4		1		56.1	
SCSS 8400FD	27-Jul-93	i		36	J			16.7			•	95.4	ļ
SCSS 10400	27-Jul-93			46.2	J			23.8		1		28.3	ì
SCSS 12400	27-Jul-93	İ		44.8	J			38.2				31.4	
SCSS 14400	26-Jul-93			87.8	J	1		29.2		ļ		18.9	
SCSS 15500	26-Jul-93			56.1	J	•		19.6		Ī		9.4	
SODA N	25-Oct-91	7280	J	8.2	J	2.7		25.1	J	13	J	7	
SODA OUTFLOW	25-Oct-91	7680	J	12	J	3		61	j	18	J	22	
SODA S	25-Oct-91	8460	J	15	J	3		29.6	J	19	J	16	
SODA UP FAR	25-Oct-91	3300	J	4.6	J	4		10.7	J	4	J	1	U
SODA UP MID	25-Oct-91	8780	J	8.6	J	3.5		8.3	J	9.5	J	5	
SODA UP NEAR	25-Oct-91	7350	J	5.4	J	2		13.4	. J	8.5	J	2	!
SWSS 100	27-Jul-93	1		5.2	İj	ļ		9.6			1	34.5	]

ESTIMATED VALUE

J NOT DETECTED, VALUE REPORTED IS THE SQL

### CHEMICAL ANALYTICAL RESULTS FOR INORGANIC PARAMETERS IN STREAM SEDIMENTS, MONSANTO PHASE II RI/FS

LOCATION	DATE	IRC 7439-		FLUO	RIDE	LE/ 7439		MANG 7439		MOLYB	DENUM	NICI 7440			SSIUM 1-09-7
		mg/kg	QUAL	mg/kg	QUAL	mg/kg	QUAL	mg/kg	QUAL	mg/kg	QUAL	mg/kg	QUAL	mg/kg	QUAL
HSS3 100	27-Jul-93									1.5	5	18.9			
MSSS 100	12-Dec-92							99.5		2.2		93.9			
SCSS 100 UP	27-Jul-93									6.5					ļ
SCSS 600	03-Dec-92					ļ				1.4	U	15.7	1		l
SCSS 700	04-Dec-92									3.5	U	31			
SCSS 900	04-Dec-92									2.6	U	37.7			
SCSS 1200	04-Dec-92					1				1.9	U	44.8	l	ł	
SCSS 2400	03-Dec-92					1	1			4.2	U	72.4	1		
SCSS 4400	27-Jul-93		•			1	Î l		į.	6.4		35.3			
SCSS 6400	27-Jul-93	· ·				i				4.7		39.3		ļ	1
SCSS 8400	27-Jul-93					l				4.1		23.2			
SCSS 8400FD	27-Jul-93									5		27		1	1
SCSS 10400	27-Jul-93	}				1	1			3.6		25.2			1
SCSS 12400	27-Jul-93									4.2		34.7			
SCSS 14400	26-Jul-93		i i							3.6		27.6		1	1
SCSS 15500	26-Jul-93					i				3.3		26.8		i	ł
SODA N	25-Oct-91	1940	ارا	2.3		1 11		1200				82.3		1350	L
SODA OUTFLOW	25-Oct-91	1730	ارا	2.1		11		693				153		1020	j
SODA S	25-Oct-91	1970	ا رَ ا	1.7		10		1270				89	l	1390	رَ
SODA UP FAR	25-Oct-91	1220	ارا	3.3		1.8		481				52		1420	Ĵ
SODA UP MID	25-Oct-91	9580	ן נ	2.2		7.5		913				52		7700	ŭ
SODA UP NEAR	25-Oct-91	1100	ا رّ ا	4.9		7.5	ŀ	1050				62	l	9400	رّ ا
SWSS 100	27-Jul-93					1		1	1	1.5	U	39.4	ļ		1

J ESTIMATED VALUE

U NOT DETECTED, VALUE REPORTED IS THE SQL





913-1101.608 page 3 of 3

### CHEMICAL ANALYTICAL RESULTS FOR INORGANIC PARAMETERS IN STREAM SEDIMENTS, MONSANTO PHASE II RI/FS

LOCATION	DATE	SELEN 7782-		SILV 7440-			DIUM -23-5	VANAI 7440-		ZIN 7440-	-	p	Н	CEC
		mg/kg	QUAL	mg/kg	QUAL	mg/kg	QUAL	mg/kg	QUAL	mg/kg	QUAL		QUAL	
HSS3 100	27-Jul-93	2.3	J	1.8	U			19.7	J			7.01	J	
MSSS 100	12-Dec-92	347		0.19	J			8.4		372	1	6.97		
SCSS 100 UP	27-Jul-93	0.6	J								1			Ì
SCSS 600	03-Dec-92	3.6	R	0.08	ພ			50.2	j		1	6.75		ŀ
SCSS 700	04-Dec-92	4.8	R	1.3		j		120	J		i i	6.92		
SCSS 900	04-Dec-92	1.9	R	0.17	υ	1		92.4	J		ł	6.63		ļ
SCSS 1200	04-Dec-92	20.4	j	0.11	IJ	1	1	53.2	j			6.43		l
SCSS 2400	03-Dec-92	63.1	J	0.25	UJ	Ì	ĺ	103	J			7.04		1
SCSS 4400	27-Jul-93	7.3	j	1.8	U			103	J			7.13	J	l
SCSS 6400	27-Jul-93	3.3	j	1.8	U	1		85.6	J i			7.15	j	1
SCSS 8400	27-Jul-93	1.7	J	1.8	U	}		128	J			7.1	J	Į.
SCSS 8400FD	27-Jul-93	1.1	U	1.8	U			132	J			7.23	j	}
SCSS 10400	27-Jul-93	3.8	J	1.8	U	Ī		145	J			7.26	J	i
SCSS 12400	27-Jul-93	5.2	J j	1.8	U	ł		159	J			6.83	ر	
SCSS 14400	26-Jul-93	1.1	υ	1.8	u	1		100	J			6.98	J	ļ
SCSS 15500	26-Jul-93	1.2	J	1.8	Ü	İ		86.9	j			7.08	Ĵ	Ì
SODA N	25-Oct-91	1		0.2		600		94		100		7.1		33.
SODA OUTFLOW	25-Oct-91	0.8		0.5		700		114		170	1	7.9		65.
SODA S	25-Oct-91	1.2		0.5		800		208		110	1	7.6		58.
SODA UP FAR	25-Oct-91	0.6	υ	0.1		900	1	17		27	Ì	7.6	Ì	37.
SODA UP MID	25-Oct-91	0.6	υ	0.1		400		23		45	l	7.5		33.
SODA UP NEAR	25-Oct-91	0.6	U	0.1		500		30		47	1	7.1		31
SWSS 100	27-Jul-93	5.1	J	1.8	U			24.4	ا ر ا		l	7.6	ر ا	1

J ESTIMATED VALUE

U NOT DETECTED, VALUE REPORTED IS THE SQL

**TABLE G-4** 

### ANALYTICAL RESULTS FOR RADIOLOGICAL PARAMETERS IN STREAM SEDIMENTS, MONSANTO PHASE II RI/FS

LOCATION	DATE	ANALYSES		EAD-210		POTA	ASSIUM-40	1	P(	OLONIUM-2	10
			@ 46 KeV	ERROR	QUAL	@ 1460 KeV	ERROR	QUAL	TOTAL	ERROR	QUAL
	1		pCi/g	(+/-)		pCi/g	(+/-)		pCi/g	(+/-)	
			(dry)			(dry)			(dry)		
SODA N	25-Oct-91		0	0.3		3.3	0.7		0.5	0.1	
SODA UP FAR	25-Oct-91		0.8	0.3		4	0.6		0.5	0.2	
SODA S	25-Oct-91	İ	0.5	0.2		5.3	0.8		0.6	0.2	
SODA UP MID	25-Oct-91		0.4	0.3		5.4	0.8		0.6	0.2	
SODA UP NEAR	25-Oct-91		0.1	0.3		6.9	0.8		0.9	0.2	
SODA OUTFLOW	25-Oct-91	ľ	3.6	1.1		8.3	2.8		3.3	0.4	
SCSS 700	04-Dec-92	TOTAL	1						0.6	0.2	U
SCSS 600	04-Dec-92	TOTAL				İ			0.6	0.3	U
SCSS 900	04-Dec-92	TOTAL	l i						0.6	0.3	υ
MSSS 100	12-Dec-92	TOTAL					İ		1.3	0.6	
SCSS 1200	04-Dec-92	TOTAL			,				1.5	0.6	
SCSS 2400	03-Dec-92	TOTAL			ļ .				2.3	0.9	
SCSS 4400	27-Jul-93	1							0.7	0.3	j
SCSS 6400	27-Jul-93								1.4	0.3	
SCSS 8400 FD	27-Jul-93	l	]						1.6	0.4	
SCSS 8400	27-Jul-93								1.6	0.4	
SCSS 10400	27-Jul-93	l	]		[				1.5	0.4	
SCSS 12400	27-Jul-93	1	]						2.6	0.6	
SCSS14400	26-Jul-93	1	]						1.0	0.3	
SCSS15500	26-Jul-93	1							0.8	0.3	J
HSS3 100	27-Jul-93	1	1			1			1.4	0.4	_
SWSS 100	27-Jul-93	1	1			1			0.3	0.2	







#### ANALYTICAL RESULTS FOR RADIOLOGICAL PARAMETERS IN STREAM SEDIMENTS, MONSANTO PHASE II RI/FS

LOCATION	DATE	ANALYSES	RA	DIUM-226		R <i>A</i>	DIUM-228		TH	ORIUM-228	3	THO	ORIUM-23	0
	1		TOTAL	ERROR	QUAL	TOTAL	ERROR	QUAL	TOTAL	ERROR	QUAL	TOTAL	ERROR	QUAL
			pCi/g	(+ <i>I</i> -)		pCi/g	(+ <i>l-</i> )		pCi/g	(+/-)	i l	pCi/g	(+/-)	i
	1		(dry)			(dry)			(dry)			(dry)	<u> </u>	<u> </u>
SODA N	25-Oct-91		0.4	0.2		0.3	0.2	ľ	0.4	0.1		0.4	0.1	
SODA UP FAR	25-Oct-91		0.6	0.2	1	0.6	0.2		0.5	0.2		0.5	0.2	<u> </u>
SODA S	25-Oct-91		0.6	0.2		0.4	0.2	i l	0.3	0.1		0.7	0.2	i
SODA UP MID	25-Oct-91		0.6	0.2		0.4	0.2		0.3	0.1		1.4	0.3	
SODA UP NEAR	25-Oct-91		0.8	0.2		1	0.2	}	0.6	0.2		0.8	0.2	
SODA OUTFLOW	25-Oct-91		0.8	0.8		2.3	0.8		0.5	0.2	, ·	0.9	0.2	
SCSS 700	04-Dec-92	TOTAL												
SCSS 600	04-Dec-92	TOTAL									1			
SCSS 900	04-Dec-92	TOTAL								ŀ	1			l
MSSS 100	12-Dec-92	TOTAL									ł			Ĭ
SCSS 1200	04-Dec-92	TOTAL	1								ŀ		1	
SCSS 2400	03-Dec-92	TOTAL									<u> </u>			

### ANALYTICAL RESULTS FOR RADIOLOGICAL PARAMETERS IN STREAM SEDIMENTS, MONSANTO PHASE II RI/FS

LOCATION	DATE	ANALYSES	T	HORIUM-23	2	URANIUM		
			TOTAL pCi/g (dry)	ERROR (+/-)	QUAL	TOTAL pCi/g (dry)	ERROR (+/-)	QUAL
SODA N	25-Oct-91	1	0.2	0.1		0	0.3	U
SODA UP FAR	25-Oct-91		0.2	0.1		0	0.4	U
SODA S	25-Oct-91	1	0.1	0.1		0.6	0.4	
SODA UP MID	25-Oct-91		0.3	0.1		0.6	0.5	
SODA UP NEAR	25-Oct-91	1	0.3	0.1		0.5	0.4	
SODA OUTFLOW	25-Oct-91		0.4	0.2		0	1.2	U
SCSS 700	04-Dec-92	TOTAL						
SCSS 600	04-Dec-92	TOTAL				<b>!</b>		
SCSS 900	04-Dec-92	TOTAL						
MSSS 100	12-Dec-92	TOTAL						
SCSS 1200	04-Dec-92	TOTAL				ļ		
SCSS 2400	03-Dec-92	TOTAL						

# APPENDIX G-3 TOXICITY ANALYTICAL RESULTS



PROJECT# 93041-6

TEST#:

931230

SAMPLE#: 93313-1to9

DATE:

93/08/02

#### **TOXICITY TEST RESULTS**

TEST:

ALGAL GROWTH, 72h INHIBITION/STIMULATION MICROPLATE (TP010b)

SAMPLE REF:

Golder Associates, Redmond, Washington, U.S.A.

Soda Creek sediments (sampled 93/07/28)

PROTOCOL:

Biological Test Method: Growth Inhibition Test Using the Freshwater Alga

Selenastrum capricornutum. Environment Canada, 1992. EPS 1/RM/25.

**RESULTS:** 

SEE PAGE 3 FOR RESULTS

**VERIFIED BY:** 

on: 93/8/2

**SAMPLE#:** 93313-1to9

CLIENT#: 93041-6

## PAGE 2: SAMPLE AND TEST INFORMATION

OPERATION Deduction	
OPERATION: Redmond, Washington	
STREET: 4104 148 Ave N.E. CONTACT: David Banton	
CITY: Redmond TEL: 206-883-0777 FA	X: 206-882-5498
PROV/STATE: Washington SUBLET: not applicable	200 002 0436
COUNTRY/PC: USA 98052 BILLING: not given	

### SAMPLE INFORMATION

SAMPLE:	Soda Creek sediments			TYPE:	composite
COMMENTS:	See chain of custody record		<del> </del>		composite
COLLECTED BY:	T. Norton	DATE:	93/07/28	TIME:	0830-1025

### SAMPLE SHIPMENT

CONTAINER:	nine 500mL bottles	COMMENT:	in cooler on ice	
CARRIER:	Federal Express	DATE:	93/07/28	

### TESTING FACILITY

LOCATION:	HydroQual Laboratories I	_td., 3-6125 12th St. S.E., Calga	rv. AB T2H 2K1	
CONTACT:	S. Goudey/D. Lintott	TEL: (403) 253-7121	FAX: (403) 252-9	363
RECEIVED BY:	B. Johnston	DATE: 93/07/29	TIME:	1000
SEALED:	yes, seals 8662,8663	COMMENT: seals intact u		1000
COLOUR:	brown	ODOUR: organic		
COMMENTS:	no comment			<del></del>

### INITIAL CHEMISTRY

001177		~			
COND(uS/cm):	not done	DO (mg/L):	not done	HARDNESS (mg/L CaCO3):	not done
pH:	not done	T (oC):	not done	NH4+(mg/L): not done	HOL GOILE
TRC(mg/L):	not done			The territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territory and the territor	

## SAMPLE HISTORY

STORAGE:	5oC room in the dark			**************************************	
DISPOSAL:	to sewer	DATE:	not available	BY:	not available
COMMENTS:	no comments			<u> </u>	not available

### PAGE 3 TEST DATA

SAMPLE	SAMPLE	Γ	T	SAMPLE	1 %	
NUMBER	IDENTIFICATION	pH	COND	STRENGTH	CONTROLS	5:0
				1%	85	<del></del>
93313-1	SCB3-100UA	1		10%	]	SIG LESS
		6.7	738	100%	35	SIG LESS
		0.7	750	<del> </del>	3	SIG LESS
93313-2	SCB3-100UB			1%	77	SIG LESS
35515-2	3083-10008			10%	69	SIG LESS
		6.8	631	100%	42	SIG LESS
00040 0				1%	>100	
93313-3	SCB3-100UC			10%	92	SIG LESS
		7.1	649	100%	44	SIG LESS
				1%	>100	
93313-4	SCB3-2400A			10%	50	SIG LESS
		7.0	1250	100%	10	SIG LESS
				1%	>100	
93313-5	SCB3-2400B			10%	64	SIG LESS
	·	7.0	1222	100%	15	SIG LESS
				1%	97	
93313-6	SCB3-2400C			10%	64	SIG LESS
		7.2	770	100%	20	SIG LESS
		Ì		1%	93	SIG LESS
93313-7	SCB3-100DA			10%	34	SIG LESS
		6.6	1305	100%	5	SIG LESS
		ł		1%	>100	
93313-8	SCB3-100DB			10%	>100	
		6.6	740	100%	9	SIG LESS
ľ				1%	>100	
93313-9	SCB3-100DC		İ	10%	26	SIG LESS
		7.0	700	100%	2	SIG LESS



DATE:

93/8/13

REF:

931305

PROJ:

93041-6

SAMPLE:

93313

#### TOXICITY TEST RESULTS

TEST:

Sediment Chromotest (TP008c)

SAMPLE REF:

Golder Associates, Redmond, Washington, U.S.A.

Soda Creek sediments (sampled 93/07/28)

PROTOCOL:

THE SEDIMENT CHROMOTEST, Direct Sediment Toxicity - Testing Procedure

version 1.2. 1993. Environmental Bio Detection Inc. Brampton, ON, Canada.

**RESULTS:** 

SAMPLE	SAMPLE	NOEC
NUMBER	מו	(%)
93313-1	SCB3-100UA	12.5
93313-2	SCB3-100UB	25
93313-3	SCB3-100UC	25
93313-4	SCB3-2400A	6.25
93313-5	SCB3-2400B	<6.25
93313-6	SCB3-2400C	12.5
93313-7	SCB3-100DA	25
93313-8	SCB3-100DB	12.5
93313-9	SCB3-100DC	6.25

#### **COMMENTS:**

- Toxicity is measured as a reduction in beta-galactosidase activity.
- The results are reported as the highest sample concentration tested that did not have an effect on enzyme activity (NOEC).

**VERIFIED BY:** 

ON: 93/8/13

**SAMPLE#**: 93313-1to9

CLIENT#: 93041-6

# PAGE 2: SAMPLE AND TEST INFORMATION

Celening Charlen			CLIENT:	Golder Associates		
			OPERATION	: Redmond, Washin	gton	
STREET:	4104 148 Ave N.E.	<b>.</b>		David Banton		
CITY:	Redmond		TEL:	206-883-0777	FAX:	206-882-5498
PROV/STATE:	Washington		SUBLET:	not applicable	1 ///	200-002-5498
COUNTRY/PC:	USA	98052	BILLING:	not given		

## SAMPLE INFORMATION

SAMPLE:	Soda Creek sediments			TVDE	
	See chain of custody record			TYPE:	composite
COLLECTED BY:		DATE:	93/07/28	TIME:	0830-1025
				1 11116	0030-1025

### SAMPLE SHIPMENT

CONTAINER:	nine 500mL bottles	COMMENT:	in cooler on ic	ce
CARRIER:	Federal Express	DATE:	93/07/28	

### TESTING FACILITY

LOCATION:	HydroQual Laboratories	Ltd., 3-6125 12th St. S.E., Calgar	V AR TOH OK	
CONTACT:	S. Goudey/D. Lintott	TEL: (403) 253-7121		
RECEIVED BY:	B. Johnston	DATE: 93/07/29	TIME:	
SEALED:	yes, seals 8662,8663	COMMENT: seals intact up		1000
COLOUR:	brown	ODOUR: organic	JOH arrival	·
COMMENTS:	no comment		<del></del>	

INITIAL CHI	MISTRY				
COND (uS/cm):	not done	DO (mg/L):	not done	HARDNESS (mg/L CaCO3):	not done
pH:	not done	T (oC):	not done	NH4+(mg/L): not done	not done
TRC(mg/L):	not done			The done	

## SAMPLE HISTORY

STORAGE:	5oC room in the dark			
DISPOSAL:	to sewer	DATE: not available	DV.	
COMMENTS:	no comments	not available	BY:	not available

### PAGE 3 TEST DATA

SAMPLE	SAMPLE	рН	COND	SAMPLE	RESPONSE	COMMENT
NUMBER	ID	unite	uS/cm	STRENGTH (%)	1	Johnson
				6.25	2	NOT TOXIC
93313-1	SCB3-100UA	6.7	738	12.5	2	NOT TOXIC
			1	25	1	110.1000
	<u> </u>		İ	50	0	TOXIC
				6.25	2	NOT TOXIC
93313-2	SCB3-100UB	6.8	631	12.5	2	NOT TOXIC
				25	2	NOT TOXIC
			<u>                                     </u>	50	1	1
1.				6.25	2	NOT TOXIC
93313-3	SCB3-100UC	7.1	649	12.5	2	NOT TOXIC
				25	2	NOT TOXIC
				50	1	
				6.25	1	
93313-4	SCB3-2400A	7.0	1250	12.5	0	TOXIC
				25	0	TOXIC
				50	0	TOXIC
				6.25	1	
93313-5	SCB3-2400B	7.0	1222	12.5	1	
				25	0	TOXIC
<u> </u>				50	o	TOXIC
1				6.25	. 2	NOT TOXIC
93313-6	SCB3-2400C	7.2	770	12.5	2	NOT TOXIC
				25	0	TOXIC
				50	o	TOXIC
		1		6.25	2	NOT TOXIC
93313-7	SCB3-100DA	6.6	1305	12.5	2	NOT TOXIC
				25	2	NOT TOXIC
				50	0	TOXIC
		l		6.25	2	NOT TOXIC
93313-8	SCB3-100DB	6.6	740	12.5	2	NOT TOXIC
	ļ	}		25	1	
				50	0	TOXIC
		- 1	1	6.25	2	NOT TOXIC
93313-9	SCB3-100DC	7.0	700	12.5	1	
		Ì		25	0	TOXIC
				50	0	TOXIC

NOTE: The response is based on the intensity of a coloured reaction which is a relative measure of enzyme activity.

A value of two is dark blue and not toxic.

# APPENDIX G-4

EVALUATION OF SEDIMENT CHEMISTRY, TOXICITY, AND BENTHIC INVERTEBRATE COMMUNITY STRUCTURE IN SODA CREEK AND ALEXANDER RESERVOIR

Golder Associates Inc.

4104-148th Avenue, NE Redmond, WA 98052 Telephone (206) 883-0777 Fax (206) 882-5498



# EVALUATION OF SEDIMENT CHEMISTRY, TOXICITY, AND BENTHIC INVERTEBRATE COMMUNITY STRUCTURE IN SODA CREEK AND ALEXANDER RESERVOIR

Prepared for:

Monsanto Chemical Company Soda Springs, Idaho

Prepared by:

Golder Associates Inc. Redmond, Washington

November 27, 1995

913-1101.0603

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#### Attachments:

- I 10 Day Survival and Growth Test Results
- II Soda Creek and Alexander Reservoir Sediment Data and Data Validation Summary

## 1. INTRODUCTION

This report documents work completed to date on investigations to characterize the quality of sediment and surface water in Soda Creek and Alexander Reservoir, near Soda Springs, Idaho. The work is part of the Remedial Investigation/Feasibility Study (RI/FS) of the Monsanto Company Elemental Phosphorus Plant in Soda Springs, Idaho.

As part of the remedial investigation (RI) sediments were collected from Soda Creek in 1992 (Phase I) and 1994 (Phase II). The Phase I investigations focused on determining if non-contact cooling water was a potential source of constituent input to Soda Creek (Golder 1992). Following additional sediment sampling as part of the Phase II RI, groundwater discharge of constituents of potential interest to Soda Creek has also been identified as a potential source of interest (Golder 1994a). Based on data collected to date, the U.S. Environmental Protection Agency (USEPA) concluded in the ecological risk assessment for the site (USEPA 1995) that cadmium and selenium in sediments posed a potential risk to sensitive aquatic organisms in Soda Creek.

Alexander Reservoir is an impoundment of the Bear River near Soda Springs, that supports a sport fishery and provides habitat to migratory birds. No measurements of water or sediment quality in Alexander Reservoir were made during either the Phase I or Phase II RI activities at the Monsanto site.

As a result of the potential risk to organisms in Soda Creek, the USEPA requested that Monsanto conduct additional sampling of sediment and macro-invertebrates in both Soda Creek and Alexander Reservoir. The purpose of the sampling was to determine the quality of the sediment and water in Soda Creek and Alexander Reservoir and whether the aquatic community in either Soda Creek or Alexander Reservoir had been affected by discharge of either the non-contact cooling water or the natural discharge of affected groundwater from springs south of the Monsanto plant.

Monsanto prepared a work plan to complete the sediment and water quality investigation (Golder, 1994b). The Work Plan was approved by the USEPA on November 2, 1994.

The objectives of the Work Plan were:

- to determine the concentrations and spatial distributions of constituents of potential interest (especially cadmium and selenium) in sediments of Soda Creek and in Alexander Reservoir at the mouth of Soda Creek;
- to sample suitable reference (background) sediments from Soda Creek and Alexander Reservoir for comparison purposes;
- to characterize the physical nature of the sediments;
- to characterize the biological toxicity of the sediments;
- to characterize the benthic invertebrate community structure at sample locations;

- to characterize the water quality overlying the sampled sediments; and
- to ensure sediment samples (test sediments and reference sediments) were collected from similar depositional environments to minimize variability.

To evaluate sediment quality in both Soda Creek and Alexander Reservoir, the Sediment Quality Triad (Triad) approach (Chapman 1992) was adopted. By using this approach, the information from: 1) chemical analyses on presence, concentration, and variability of constituents of potential interest; 2) ecological surveys on community structure of benthic invertebrates; and 3) toxicity testing are integrated to determine whether adverse ecological effects have occurred. If these effects are observed then the information can be used to establish a link between these adverse effects and the chemistry of the site. This memorandum describes all sediment and water quality data that has been collected from Soda Creek and Alexander Reservoir during all phases of the RI at the Monsanto plant.

## 2. ENVIRONMENTAL SETTING

## 2.1 Soda Creek

Soda Creek is a tributary to the Bear River in southeastern Idaho. Soda Creek forms the main surface water drainage feature of the valley north of Soda Springs. The valley is bordered by Soda Springs Hills and Ninety Percent Range on the west, the Blackfoot Reservoir on the north, the Aspen Range on the east, and the Bear River on the south (Figure 2-1). Soda Creek originates at Fivemile Meadows, an area of marshland and springs, flows south to Soda Creek Reservoir and eventually discharges into Alexander Reservoir west of the City of Soda Springs. Average annual flows for Soda Creek (at the Fivemile Meadows gauge for 1965 to 1986) is 18 cubic feet per second (cfs) (Hydrosphere 1993). Soda Creek passes within 2,000 feet of the Monsanto plant.

From Fivemile Meadows, Soda Creek flows into Soda Creek Reservoir, that has an approximate storage capacity of 2,500 acre-feet. Much of the water released from the reservoir re-enters Soda Creek through a spillway and a powerhouse located approximately 5,000 feet downstream of the reservoir. Further downstream of this powerhouse is the outfall used by Monsanto for discharge of non-contact cooling water (Section 3). Immediately downstream of the outfall (approximately 100 feet) is a diversion dam that redirects all of the Soda Creek flow year-round into a canal. Below this dam, Soda Creek is a meandering trickle with flows considerably less than one cfs. The flow rate in Soda Creek increases downstream due to groundwater discharge to the creek. Specific discharge points to Soda Creek downstream of the diversion dam are Southwest Springs, Mormon/Calf Springs, and Homestead Spring. Southwest Springs inflow is approximately 1,000 feet downstream of the diversion dam. Inflow to Soda Creek from Southwest Springs is less than 0.2 cfs. The inflow from Mormon/Calf Springs is approximately 1,500 feet downstream of the diversion dam. Inflow to Soda Creek from Mormon/Calf Springs is less than 0.2 cfs. Homestead Spring is approximately 4,500 feet downstream of the diversion dam and inflow is less than 0.02 cfs. Approximately 5,000 to 6,000 feet downstream of the diversion dam are two powerhouses, through which a portion of the Soda Creek flow is returned to the creek. The flow returned to the creek depends on power generation and demand for irrigation water. A second diversion dam on Soda Creek is located approximately 2,000 feet below the last powerhouse. This dam diverts water from Soda Creek into Soda Canal during the summer months. The remaining water in Soda Creek continues to flow southwest into Alexander Reservoir. The Soda Creek hydrology is illustrated schematically in Figure 2-2.

The Idaho Department of Health and Welfare (IDHW) has conducted evaluations of Soda Creek and tributaries in the vicinity of the Monsanto Plant. The state reports that Hooper Springs - a natural, sodic spring outside of the Plant boundaries has a natural but severe impact on the aquatic life in Soda Creek (Perry, J., IDHW- Division of Environment [Memo to G. Hopson, IDHW-Division of Environment] March 22, 1976). Hooper Spring discharges into Soda Creek to the west of the Monsanto Plant, well above the point of confluence with

Monsanto's National Pollution Discharge Elimination System (NPDES)-permitted, non-contact cooling water discharge into Soda Creek.

The IDHW study indicated that the diversity of Soda Creek benthic macroinvertebrate community is decreased due to the naturally-occurring highly mineralized and carbonated spring water that feeds the creek. This study did not document any unique habitat or "soda-dependent" species in Soda Creek. The impact due to the high carbon dioxide content has been measured from the headwaters down to and below the outfall of the plant discharge. The water quality does improve in the lower reaches of the creek after the gas concentration has decreased, allowing the macroinvertebrate population to recover.

The IDHW study also included a fish survey. No fish were noted within the upper portions of Soda creek due to the harsh environmental conditions imposed by the naturally carbonated springs that feed the creek. Small numbers of fish (salmonids) were noted in the lower reaches of Soda Creek, about one mile above the confluence with the Bear River. The study concluded the Soda Creek ecosystem in proximity to the Plant consists of only "other aquatic life", and that no adverse environmental effects could be found to be attributable to the Monsanto discharge.

Soda Creek is not considered a sensitive habitat because it does not provide significant fish habitat. In addition, it is not critical habitat because no sensitive, threatened or endangered species use the creek as habitat.

## 2.2 Alexander Reservoir

Alexander Reservoir is an impoundment of the Bear River (Figure 2-1) downstream of the City of Soda Springs' wastewater treatment plant. The reservoir is used for recreation, irrigation, and hydroelectric power generation. During 1986 and 1988, average annual storage capacity was 12,410 and 12,607 acre-feet, respectively (Hydrosphere 1992). Minimum flows below the dam are 150 cfs. Normal elevation of the reservoir surface is 5,716 feet above sea level. During power generation, the reservoir elevation may fluctuate one to three feet.

Alexander Reservoir provides a marginal rainbow trout and yellow perch fishery. The reservoir also provides seasonal habitat for bald eagles, white pelicans, and Canada Geese.

## 3. PREVIOUS SURFACE WATER AND SEDIMENT INVESTIGATIONS

During Phase I and Phase II RI activities at the Monsanto Plant, samples were collected from the non-contact cooling water (Phase I), surface water from Soda Creek and associated springs (Phase I), and sediments from Soda Creek (Phase I and II). The exposure pathways conceptual model for the Monsanto Plant (Golder 1991) identified the discharge of non-contact cooling water to Soda Creek as a potential exposure pathway for humans and ecological receptors. Therefore, samples were collected to evaluate the non-contact cooling water as a potential source and to determine the nature and extent of constituents of potential interest in the aquatic environment. The following briefly summarizes sampling and analysis conducted during the RI. Specific details are provided in Golder 1992 and 1994a.

The non-contact cooling water is used to cool the furnace shell and other equipment during phosphorus production. The water is obtained from production wells at the plant. The water passes over the outer furnace shell to maintain proper temperature and does not contact any process material. After leaving the furnace the water passes through a settling pond for cooling and particulate removal prior to being discharged, under a National Pollution Discharge Elimination System permit to Soda Creek. The non-contact cooling water is discharged into Soda Creek at an average annual rate of 4.5 cfs from an outfall immediately upstream of the diversion dam. Three samples were collected during the Phase I RI (Golder 1992) and results are shown in Table 3-1. Constituents detected in the non-contact cooling water are cadmium, calcium, fluoride, magnesium, nitrate-nitrogen, ortho-phosphate, selenium, sodium, and sulfate. Estimated constituent loading to Soda Creek from the discharge of non-contact cooling water is shown in Table 3-3.

A total of six surface water samples were collected from Soda Creek during the Phase I RI to determine if the constituents found in the effluent affected the water quality of Soda Creek (Golder 1992). Sample locations are shown in Figure 3-1. Three samples each were collected upstream and downstream of the Monsanto outfall. Because of the complete diversion of Soda Creek flow, the three samples downstream of the outfall were actually collected in the diversion canal. Analytical results for the surface water samples are shown in Table 3-1. A statistical comparison (t-test) between the reference (upstream) sample group and downstream sample group was made to determine which constituents attributable to Monsanto were present at elevated concentrations. The only chemical constituents found at statistically significant elevated concentrations downstream of the outfall in surface water were calcium, chloride, nitrate-nitrogen, sodium, and sulfate.

The water quality of Mormon Springs, which discharges into Soda Creek (Figure 3-1) has also been measured as part of the RI at Monsanto. Analytical results from water samples collected from Mormon Springs (Mormon A) since 1991 are summarized in Table 3-2. Results of the Phase II RI show that Mormon Springs is a discharge point for groundwater that migrates beneath the Monsanto Plant within the UBZ-2 groundwater zone (Golder 1994a). The RI identified a potential for future discharge of cadmium, fluoride, manganese,

molybdenum, nickel, nitrate, and selenium from the UBZ-2 zone to Soda Creek. Estimated constituent loading to Soda Creek from Mormon Springs discharge is shown in Table 3-3.

Sediment samples from Soda Creek were collected during Phases I and II of the RI (Golder 1992 and 1994a). Samples were collected upstream (reference) and downstream of the non-contact cooling water outfall, and in several spring-fed creeks (Southwest, Mormon/Calf, and Homestead Springs), upstream from their confluence with Soda Creek. Sample locations are shown on Figure 3-2. In addition to testing for chemical constituents, selected sediment samples from Soda Springs were screened for biological toxicity during the Phase II RI. Chemical analyses for Soda Creek sediments collected during Phases I and II are summarized in Tables 3-4 and 3-5, respectively. The results of Phase II biological toxicity testing are shown in Table 3-6.

Based on data collected during the Phases I and II investigations, the Phase II RI concluded that arsenic, cadmium, nickel, selenium, silver, vanadium, and polonium-210 were present at elevated concentrations in sediments collected downstream of the Monsanto outfall. Although sediment samples collected downstream of the Monsanto outfall had higher toxicities than reference sediment samples, the reference samples had an inherent toxicity relative to laboratory controls. Consequently, the toxicity testing did not conclusively show that constituents released to Soda Creek, either through the outfall or through groundwater discharge, could cause an adverse ecological effect.

Using information from the Phase II RI, USEPA performed an ecological risk assessment that included Soda Creek sediments (USEPA 1995). The risk assessment evaluated potential exposure of aquatic receptors to constituents found in sediments. The risk assessment characterized the aquatic habitat of Soda Creek as naturally harsh due to high levels of carbon dioxide in the water. Consequently, the creek does not support a rich (i.e., diverse) ecosystem nor provide a trout fisheries resource, except near the confluence with Alexander Reservoir. The risk assessment evaluated impairment of aquatic habitat as an ecological endpoint by comparing sediment and water quality to proposed or promulgated criteria. For sediments, the risk assessment found that arsenic, cadmium, copper, nickel, and selenium all exceeded surrogate sediment quality reference levels. The risk assessment concluded, however, that because Soda Creek represented a limited habitat, there was little potential for adverse impact due to the presence of these constituents in sediment.

### 4. CURRENT INVESTIGATION

The current investigation was required by USEPA to provide additional information for the Phase II RI on the potential effect to the aquatic environment of Soda Creek or Alexander Reservoir posed by releases of substances from the Monsanto plant. The information collected as part of this investigation is intended to supplement data collected by previous RI activities. The information presented is intended to resolve outstanding issues regarding ecological risk in Soda Creek.

# 4.1 Sample Locations

Based on previous investigations of Soda Creek, the creek was divided into 10 reaches that were intended to reflect similar hydrology and sediment deposition characteristics. Reach boundaries were determined during a reconnaissance survey and reviewed on November 7 and 8, 1994 by USEPA just prior to sampling. Three reaches located upstream of the Monsanto non-contact cooling water outfall were chosen for collection of reference samples (SCC-1, SCC-2, and SCC-3). The remaining seven reaches (SC-1, SC-2, SC-3, SC-4, SC-5, SC-6, and SC-7) were located downstream of the outfall to the confluence of Soda Creek with Alexander Reservoir (Figure 4-1). The reaches downstream of the outfall were selected to identify the downstream distribution of the constituents of potential interest.

Within each reach, the sample station was determined by selecting the first depositional zone encountered beginning at the downstream boundary of the reach. At each station in Soda Creek, three replicate samples (e.g., SC-1A, SC-1B, and SC-1C) were collected. Sediments from Soda Creek were sampled between November 11 to 16, 1994. Each replicate sample was collected from a 3- × 6-ft area. In addition to the depositional sample station, the closest upstream erosional zone was also sampled for benthic invertebrate analysis.

Sediments at a total of 18 stations were sampled in Alexander Reservoir (Figure 4-1) between November 6 to 10, 1994. Nine stations were located at the mouth of Soda Creek: ARS-1, ARS-2, ARS-3, ARS-4, ARS-5, ARS-6, ARS-7, ARS-8, and ARS-9. These stations were located to allow evaluation of spatial distribution in constituents of potential interest as Soda Creek enters Alexander Reservoir. The remaining nine stations (ARC-1, ARC-2, ARC-3, ARC-4, ARC-5, ARC-6, ARC-7, ARC-8, and ARC-9) were sampled as reference stations and were located in Alexander Reservoir (Figure 4-1) so as to be unaffected by Soda Creek.

# 4.2 Sample Collection

Sample collection proceeded in a downstream to upstream direction. Surface sediment samples (0 to 2.5 in) were collected from Alexander Reservoir and from depositional zones in Soda Creek using a petite Ponar grab [0.25-ft² (0.023-m²) area]. Samples were collected for benthic invertebrate analysis and for chemical, toxicity, and physical properties. Each analytical sample was a composite of two grabs of the surface layer.

Samples for chemical, toxicity, and physical properties were collected before benthic samples to minimise the possibility of cross-contamination. Samples for chemical analysis were transferred into acid washed glass sample jars; samples for toxicity testing and physical properties were transferred to one-gallon plastic bags.

Benthic samples were passed through a  $500~\mu m$  mesh sieve to remove silt. The remaining material was then transferred to a labelled, plastic, 1-L container and was preserved in 10% formalin.

A Surber sampler was used to collect benthic samples from erosional sites (Gibbons et al. 1993). The Surber sampler encompassed an area of  $1\text{-ft}^2$  (0.092-m²) and the collecting net had a mesh size of 363 µm. At each sampling site, the sampler was placed on the bottom and the enclosed bottom material was manually disturbed for approximately one minute to remove all attached invertebrates. After removal of the sampler from the stream, the contents of the net were transferred into a labelled, plastic, 1-L container and were preserved in 10% formalin. All erosional samples were taken in areas with predominantly cobble/gravel substrata as close to mid-channel as possible. The collection net was back-washed to remove any clinging organisms and the sampler was rinsed before taking the next sample.

Sediment samples were also collected at depth from five locations in Soda Creek (SCC-1, SCC-3, SC-2, SC-4, and SC-5) and four locations in Alexander Reservoir (ARC-3, ARC-6, ARS-2, and ARS-9) using a 2-inch hand corer. The objective of collecting core samples was to allow depth profiling of chemical constituents. After collection, core samples were subdivided based on observed sedimentation units and transferred into glass jars for transport to the laboratory.

Surface water samples were also collected at selected sampling stations in Soda Creek (SCC-1, SCC-3, SC-2, SC-3, SC-4, and SC-6) and Alexander Reservoir (ARC-3, ARC-6, ARS-2, and ARS-9). Water samples were collected approximately one-foot above the sediment surface. Water samples from the creek were collected directly into a sample bottle. Water samples from the reservoir were collected using a 2-L VanDorn water sample bottle and then transferred to a sample bottle. After collection, aliquots were tested for pH, conductivity, temperature, and dissolved oxygen.

Sediment samples were analyzed for arsenic, cadmium, copper, molybdenum, nickel, selenium, silver, vanadium, total organic carbon, pH, and grain-size distribution. Surface water samples were analyzed for cadmium, calcium, selenium, sodium, alkalinity, magnesium, pH, conductivity, hardness, and total dissolved solids.

# 4.3 Benthic Community Analysis

Samples of benthic invertebrates were sorted and identified according to standard methods developed using the appropriate scientific literature (Klemm et al. 1990, APHA et al. 1989, Gibbons et al. 1993). First, each sample was elutriated to remove sand and gravel and was passed through a 1-mm sieve, which separated it into coarse

and fine size fractions. Subsampling was employed only for large samples, and only for the fine size fraction, according to methods outlined by Wrona et al. (1982). Invertebrates were removed from the organic detritus under a dissecting microscope and were identified to the lowest practical taxonomic level, typically genus for most insects. Small, early instar animals were identified to the lowest taxonomic level possible, generally to family. Identifications were made using recognised taxonomic keys (Edmunds et al. 1976, Wiggins 1977, Merritt and Cummins 1984, Brinkhurst 1986, Stewart and Stark 1988, Pennak 1989, Clifford 1991). Invertebrate numbers were tabulated by site.

As a quality control measure, invertebrates from three samples (one from Alexander Reservoir; two from Soda Creek) were re-identified by an additional taxonomist. Ninety percent agreement (calculated as the sum of minimum numbers of each taxon in a re-identified sample/mean total invertebrates in the same sample  $\times$  100) was deemed as the acceptable minimum degree of agreement between taxonomists.

## 4.4 Toxicity Testing

Whole sediment toxicity tests were conducted with *Chironomous tentans* (10-day exposure) based on standard test methods (ASTM 1993). Chironomous tentans was chosen to be the test organism because it is representative of *Chironomous* spp. found in Soda Creek and Alexander Reservoir. There were two measures of toxicity: mortality (percent) and growth (dry weight/organism). Overlying dilution water was supplemented with sodium bicarbonate ( $C_{Na} = 33 \text{ mg/L}$ ) to approximate conductivity, alkalinity, and sodium content of site surface waters (Soda Creek and Alexander Reservoir).

Sediments were homogenized with interstitial water present in the sample container and dispensed into beakers. Sediments were not sieved prior to testing. Four hundred milliliters of adjusted dilution water was added to the sediments and the sediments allowed to settle overnight. Laboratory controls consisted of 100 mL of acid-washed silica sand (70 mesh) and 400 mL of the adjusted dilution water. Testing was conducted using three replicates of each sample and six replicates of each laboratory control. Test vessels were aerated for approximately one-hour prior to test initiation.

At test termination (Day 10), the sediments were sieved and the number of surviving chironomids recorded. The surviving chironomids were then dried at 60°C and weighed to assess growth.

## 4.5 Data Analysis and Statistics

The data for Soda Creek consists of three samples from each of the 10 stations (three reference and seven test stations). For Alexander Reservoir, the data consists of nine samples collected from a reference area and nine samples collected from the test area near the mouth of Soda Creek (Figure 3-1). Samples collected near the mouth of Soda Creek were divided on the basis of their distance from the mouth of Soda Creek into 3 groups, of 3 samples each. Group 1 (ARS-1, ARS-2, and ARS-3) is the farthest from Soda Creek, Group

3 (ARS-7, ARS-8, and ARS-9) is the closest to Soda Creek, and Group 2 (ARS-4, ARS-5, and ARS-6) is between the other two groups.

The chemical concentrations in the creek and reservoir sediment samples were standardized to sample clay content to minimize differences because of changes in sample grain-size. Clay content was used because these particles have a relatively large surface area to volume ratio and a surface electric charge. Together these properties increase the likelihood of constituent sorption and make the clay fraction more chemically and biologically reactive (Power and Chapman 1992).

Samples with results that were less than the detection limit were replaced with one-half the detection limit. Molybdenum concentrations in reservoir samples were all less than the detection limit and only Soda Creek stations SC-2 and SC-3 had all three samples above the detection limit. Consequently, molybdenum was not included in the statistical analyses for either the creek or the reservoir.

Before data analysis, the invertebrate data matrices were reduced to exclude rare taxa (Culp and Davies 1980, Pontasch et al. 1989, Corkum 1990, Whitehurst and Lindsey 1990). Rare species were excluded from evaluation because the presence of an individual at any given sit would not be meaninful. There is insufficient information on habitat requirements to evaluate their presence or absence. Abundant species contain most of the information in the sample, and since their densities are higher, relationships among sites may be detected more reliably (Gauch 1982). Data reduction was performed separately for Soda Creek and Alexander Reservoir. Data from samples collected in the erosional zone of Soda Creek were not included in the analysis because no chemical or toxicity data were collected.

All the statistical tests described below assume the data are normally distributed and that the variances between groups are homogenous. These tests are robust against small departures from the normality by heterogeneity of the variances. Therefore, when necessary the data was transformed to correct for the heterogeneity. The results of the statistical tests described below are considered to be significant when the probability of a false positive or Type I error (p) is 0.05 or less.

## 4.5.1 Sediment Chemistry

Variances of constituent concentrations among the creek stations or among the reservoir groups were heterogeneous. Therefore, the data was transformed (log₁₀) before statistical analysis. Comparisons of mean composition for all of the metals at each station (creek) or group (reservoir) were made using a one-way multivariate analysis of variance (MANOVA; Seber 1984). A balanced design was used for samples from the creek and an unbalanced design was used for samples from the reservoir. Given a statistically significant difference in the MANOVA, a one-way univariate analysis of variance (ANOVA; Milliken and Johnson 1984) was used to identify significant differences for individual chemical constituents. The MANOVA was performed prior to the univariate ANOVAs to maintain the false positive rate of 0.05. When one-way univariate ANOVAs are performed for each of the seven chemical constituents plus pH and evaluated independently at a false positive error rate of 0.05, the experiment - wise false positive error rate is 0.34. For significant

differences in chemical constituents in creek samples, a Tukey-Kramer multiple comparison test (Neter et al. 1985) was performed to determine simultaneously which of the stations are significantly different from the reference stations. For significant differences in chemical constituents in reservoir samples, Dunnett's multiple comparison test (Steel and Torrie 1980) was performed to determine simultaneously which of the groups are significantly different from the reference area.

## 4.5.2 Benthic Community

A MANOVA with the same design layout as described in Section 4.5.1 was performed using the benthic organisms that contribute at least 5% of the total number of invertebrates for two or more stations, total invertebrates and number of taxa. The benthic organisms included in the MANOVA for the creek were Tubificidae, Tantytarsini, Orthocladiinae, Chironomus sp., and Tanypodinae. The MANOVA for the creek was performed on the log₁₀ transformation of the data. The benthic organisms included in the MANOVA for the reservoir were Tubificidae, Chironomus sp., and Naididae.

The MANOVA indicates whether there is a statistically significant difference in the benthic fauna between two or more stations or groups. If there is no statistically significant difference in the benthic fauna, then there cannot be a significant association between the sediment chemistry and the benthic fauna. If there is a statistically significant difference in the benthic fauna and sediment chemistry, , then it needs to be determined if there is a significant association between the sediment chemistry and the benthic fauna and if this association indicates an effect on the benthic fauna community.

No statistical analysis was performed on the benthic fauna from the erosional stations.

## 4.5.3 Toxicity Testing

Three replicate toxicity tests were performed for each of the sediment samples collected in the creek and the reservoir. Additionally, there were four laboratory control toxicity tests of six replicates each. Several of the toxicity tests were found to contain leaches. Because leaches are predatory on the test organisms, samples with leaches were not used in the statistical analysis. Additionally, the statistical analysis of the growth used only those samples with surviving test organisms. Table 4-1 provides a summary of samples used for toxicity statistical analysis. There were no leaches detected in any of the Alexander Reservoir sediment samples, therefore, all of the data was acceptable and used in the toxicity statistical analysis. Additionally, the toxicity tests were repeated for two samples, those results are included in the analysis.

Comparisons of percent mortality and growth between stations (creek) and groups (reservoir) were made using an unbalanced nested ANOVA (Milliken and Johnson 1984). Significant differences were tested using the Tukey-Kramer multiple comparison test so that all pairwise comparisons are evaluated. The rank transformation of the data were used in the statistical analyses for creek samples due to the heterogeneity of variance.

## 4.5.4 Relationship Between Sediment Chemistry and Benthic Community

If there are significant differences between sites (creek stations or lake groups) for both the sediment chemistry and benthic community, then it needs to be determined if there is a significant relationship between the sediment chemistry and benthic community. Canonical Correlation Analysis (CCA) is used to determine if there is a significant relationship.

When there is one chemical and one benthic organism, a simple correlation is used to measure the degree of relationship between them. When there are several chemicals of interest, and only one benthic organism, a multiple correlation is used to measure the degree of relationship between them. The multiple correlation describes the relationship between the benthic organism and a linear combination of the chemicals which is calculated using multiple regression. The linear combination is calculated such that it has the largest possible multiple correlation, as compared to all other linear combinations of the chemicals. When analyzing the results of the multiple regression, the chemicals that make a significant contribution to this linear combination are determined. Those chemicals that do not contribute significantly to the linear combination are either those that are not related to the abundance of the benthic organism, or those that are highly correlated with another chemical and thus do not contribute any additional information.

When there are several benthic organisms and several chemicals, then the multivariate extension of multiple regression, CCA, is used to determine the significance of their relationship. CCA calculates a linear combination of the benthic organisms and a linear combination of the chemicals. These linear combinations are called canonical covariates, the coefficients in the linear combination are called canonical coefficients. The linear combinations are determined so that the correlation between the two linear combinations is as large as possible. This correlation is called the canonical correlation. A statistical test can be performed to determine if the canonical correlation is significantly greater than zero, which is equivalent to testing if there is a significant relationship between the benthic community and the sediment chemistry. Those chemicals and benthic organisms that contribute significantly to their respective canonical covariate can also be determined. As with multiple regression, those chemicals or benthic organisms that do not contribute significantly to the canonical covariates are either truly insignificant or highly correlated with other chemicals or benthic organisms, respectively.

There are more than one set of canonical covariates. Let "s" be the smaller of the number of chemicals or the number of benthic organisms being analyzed. Then there are "s" uncorrelated sets of canonical covariates that can be calculated. The first set, described above, has the highest canonical correlation. The second set has the second highest canonical correlation, the third set has the third highest canonical correlation, etc. The CCA continues until the canonical correlation of the ith set is not significantly different from zero.

The CCA is performed on standardized variables. That is, the mean and standard deviation for each chemical and benthic organism is calculated. Then the mean is

subtracted from the values and the result is divided by the standard deviation, for each chemical and benthic organism. The standardized variables are used in CCA to allow for the direct interpretation of the canonical covariates. The larger the absolute magnitude of the canonical coefficient, the larger the contribution that variable makes to the relationship.

In interpreting the meaning of a simple, multiple or canonical correlation, often the squared correlation (also called the coefficient of determination) is used. The squared correlation is the proportion of the variance of the benthic organism (or linear combination of benthic organism in CCA) that is explained by the regression on the chemical or linear combination of chemicals.

The CCA provides a statistical relationship between the benthic community and sediment chemistry. This relationship is then carefully examined to determine how it relates to the physical and ecological system being investigated. This examination includes determining if the relationship is due only to unusual conditions at a small subset of sites or is a relationship which holds across the entire system being investigated.

The statistical package SAS/STAT was used to perform the calculations for the CCA. The user's guide for this package (SAS, 1991) and multivariate textbooks such as Harris (1975) describe the equations used in CCA and the interpretation of the results.

## 5. INVESTIGATION RESULTS

#### 5.1 Sediment and Surface Water Characterization

Soda Creek and Alexander Reservoir sediment data and data validation reports are provided in Attachment II.

The physical characteristics of collected sediments are summarized in Table 5-1. Sediment organic carbon ranged from 2.4% to 9.1% (mean = 5.1%) in Soda Creek and 3.3% to 7.3% (mean = 5.5%) for reference samples. Sediment organic carbon ranged from 1.7% to 9% (mean = 4.6%) in Alexander Reservoir and 1.9% to 3.7% (mean = 2.7%) for reference samples. Sediment test samples and reference samples from the creek and the reservoir were predominantly sandy-silt-sized particles. The pH ranged from 6.4 to 7.3 (mean = 6.9) in creek sediment samples and 6.8 to 7.26 (mean = 7.0) for reference samples. The pH ranged from 7.0 to 7.4 (mean = 7.2) in reservoir sediment samples and 7.2 to 7.6 (mean = 7.4) for reference samples.

Concentrations of total metals in whole-sediment samples from Soda Creek and Alexander Reservoir are summarized in Tables 5-2 and 5-3, respectively. Station SC-3 in Soda Creek had the highest concentrations of molybdenum, nickel, and selenium; station SC-5 had the highest concentrations of cadmium, copper, and vanadium; and station SC-6 had highest concentrations of arsenic and silver. The maximum mean metal concentrations in Soda Creek sediment samples exceeded maximum mean concentrations in the reference sediment samples. In Alexander Reservoir, station ARS-8 had the highest concentrations of arsenic, copper, silver, and vanadium; and station ARS-9 had the highest concentration of cadmium. Maximum concentrations of nickel and selenium were found at both ARS-8 and ARS-9. Molybdenum was not detected in samples collected in Alexander Reservoir. Maximum metal concentrations in Alexander Reservoir test sediments exceeded maximum concentrations in reference sediments.

Metal concentrations in Soda Creek sediments do not exhibit a monotonic (unvarying) increase or decrease in a downstream direction. The whole-sediment metal concentrations for arsenic, cadmium, copper, nickel, selenium, and vanadium are plotted versus distance downstream of the diversion dam in Figures 5-1 to 5-6, respectively. Molybdenum was not plotted because molybdenum was not detected in most of the samples (Table 5-2). At site SC-2 molybdenum was detected at a low concentration (mean = 3.3 mg/kg dry weight) and again at site SC-3 (mean = 8.3 mg/kg dry weight). Silver was not plotted because it was undetected in most of the samples taken in the Phase I and Phase II investigations, therefore the trend line would not accurately illustrate the concentration gradient. These figures were constructed using data collected during this investigation, as well as during the Phase I and II RI (Golder 1992 and 1994a). To illustrate the concentration gradient, robust locally weighted regression (Cleveland 1979) was used to generate the trend line shown on the figures. This trend line was generated using metal concentrations from all of the sediment samples collected from all the sites at Soda Creek (eg., SC-1A, SC-1B, and SC-1C), excluding data from sediments collected in Mormon Springs, Southwest

Springs, and Homestead Spring that were collected during the Phase II RI. In addition to the trend line, the mean metal concentration in the reference sediments and the upper tolerance limit (UTL) are shown for comparison. If the calculated UTL exceeded the maximum reference concentration, then the maximum detected reference concentration for that analyte was substituted in place of the UTL. This was the case for all of the analytes plotted.

These concentration trends show there are two zones in the stream where metals show the greatest concentration: approximately 2,000 to 5,000 feet and 9,000 to 13,000 feet downstream of the diversion dam. Molybdenum, nickel, and selenium show trend maximums in the first zone, copper and vanadium show trend maximums in the second zone, and arsenic and cadmium show peaks occurring in both zones.

In contrast to metal concentrations in Soda Creek sediments, metal concentrations in sediments collected from the mouth of Soda Creek in Alexander Reservoir do show a relatively monotonic decrease with increasing distance from the mouth of Soda Creek. Metal concentrations are plotted versus relative distance from the mouth of Soda Creek in Figures 5-7 to 5-13. The mean (and the UTL) of the reference samples are also plotted for comparison. Except for cadmium, metal concentrations in sediments became less than the UTL as distance from Soda Creek increases.

Metal concentrations in sediment cores collected from Soda Creek and Alexander Reservoir are shown in Table 5-4. Bottom conditions in both the stream and the reservoir limited the sampling depth to approximately the upper foot of sediment. Difficult coring conditions (e.g., limited sediment depth overlying rock or coarse gravels) made it impossible to collect all of the sediment cores from Soda Creek identified in the sampling plan. The collected cores are sufficient to illustrate general trends in metal concentration with depth along the longitudinal profile of Soda Creek. However, there is insufficient data to provide a conclusive analysis on constituent depth profiles. In cores collected from Soda Creek, metal concentration with depth is relatively constant except for nickel at SCC-3; cadmium, copper, and selenium at SC-2; and cadmium, copper, and selenium at SC-5. Except for nickel at SCC-3, metal concentrations were higher in the surface sample that at depth. In cores collected from the reservoir, concentrations of silver, selenium, and vanadium at ARC-6 showed an increase with depth.

Results of surface water characterization are shown in Table 5-5. Field and laboratory conductivity, alkalinity, selenium, sodium, and TDS measured in surface water samples from Soda Creek were highest at sample station SC-2. Calcium, hardness, and magnesium were highest at sample station SC-3. Temperature and cadmium were highest at samples station SC-6. Field and laboratory pH were highest at the control sample station SCC-1 and O₂ was highest at the control sample station SCC-3. The influence of Soda Creek on measured constituents in Alexander Reservoir is evident in the different chemistry of samples from sample station ARS-9 compared to sample station ARS-2. Water collected from ARS-2 is similar to samples collected in the reference area (ARC-3 and ARC-6). Water collected at sample station ARS-9 is similar in composition to water collected at sample station SC-6.

Mean concentrations, on a clay-weight basis, are shown in Tables 5-6 and 5-7 for samples from the creek and the reservoir, respectively. For Soda Creek, the MANOVA and each ANOVA showed significant differences (p<0.0001) among Soda Creek sample stations for all metal constituents. Results of the Tukey-Kramer multiple comparison tests for the ANOVA are Figures 5-14 through 5-20 for each chemical constituent. Those mean concentrations with non-overlapping error bars show significant differences. For example, in Figure 5-14 the mean arsenic concentration (clay-weight basis) is significantly higher at station SC-2 as compared to stations SC-1, SCC-1, SCC-2 and SCC-3, but is not significantly different from all the other stations. The mean concentration (clay-weight basis) of arsenic, copper, nickel, selenium and vanadium in the sediments are significantly elevated at some sampling stations in Soda Creek compared to the reference loactions. However, the farthest downstream sampling station (SC-7) is not significantly different from one or more of the reference sampling stations for these metals. Only cadmium and silver have significant differences in the means of the sample station farthest downstream (SC-7) and the reference sampling stations.

For Alexander Reservoir, the MANOVA showed a significant difference (p < 0.0001) in the group means when considered simultaneously across all the metal constituents and pH. The results of the ANOVA and Dunnett's multiple comparison test for each metal and pH are shown in Table 5-8. This table shows there are significant difference between the group means for all the metals and pH. The multiple comparison tests for differences between the reference group and group 3 (closest to Soda Creek) are significant for all the chemical constituents (p  $\leq$  0.001) and pH (0.01 < p  $\leq$  0.05)... As seen in Table 5-7, for all the metals, the concentrations are decreasing as the distance increases from the mouth of Soda Creek

# 5.2 Benthic Community

Tables 5-9 and 5-10 give the mean and standard deviation for each of the benthic organisms, total number of invertebrates and number of taxa in Soda Creek and Alexander Reservoir, respectively.

## 5.2.1 Soda Creek

#### 5.2.1.1 Benthic Habitat

Soda Creek was characterised by two major types of invertebrate habitat: deposional and erosional. Since Soda Creek has a relatively low gradient, the predominant habitat type was depositional, characterised by slow currents, variable aquatic macrophyte cover and mostly fine depositional sediments overlain by varying amounts of organic material. Erosional areas consisted of riffles with sand/gravel/cobble substratum and moderate current velocity and were relatively scarce, which is reflected in the lower number of samples from this habitat type. The habitats at each sampling location are described in greater detail in the following sections (ordered from upstream to downstream).

# Reference Reach 3

This reach extended from the headwaters in the Five-Mile Meadows downstream to a point of distinct change in stream gradient. The lower boundary of the reach was located at the top of the first hydraulic control (riffle) observed to occur downstream of the headwaters. The depositional sampling site (SCC-3; Figure 4-1) was located approximately 20 m upstream of the head of this riffle. There was no erosional sampling site within this reach.

The upper portion of this reach is dry. The portion of the stream in the reach with flowing water consisted of fairly uniform habitat. The stream had a very low gradient, consisting of a slow and wide channel with no hydraulic controls or riffle habitat. The stream was approximately 20 -feet wide and three to four feet deep in the thalweg. Habitat types were limited to slow run/pool areas dominated by fines (particles <2 mm) throughout the width of the channel. Sediments at the sampling site in this reach (SCC-3) consisted of an unconsolidated organic layer over a firm silt/clay layer overlying the gravel streambed. Aquatic macrophytes were limited to minor development of submergent cover along the channel periphery.

## Reference Reach 2

This reach extended from the first hydraulic control (Reference Reach 3 lower boundary) downstream to the inlet to Soda Reservoir.

The stream within this reach was approximately 15 to 25 feet wide and greater than four feet deep in the thalweg. There was a good volume of flow through this reach with a noticeably higher gradient than Reference Reach 3. Habitat consisted of a series of run/riffle areas with some backwater habitat. The stream is as wide as in Reference Reach 3 and is much wider than the stream channel downstream of the reservoir. The riffle areas consisted of bedrock/boulder/cobble substrates with fairly high velocities. Sediment deposition was still significant along the stream periphery, and in backwater and velocity break areas. Aquatic macrophytes (submergent) were well developed in the backwater areas and in the slower run habitats.

The depositional sampling site (SCC-2) in this reach was located immediately (150 ft) upstream of the reservoir inlet (Figure 4-1). The channel at this location was deep and slow due to the backwater effects of the reservoir water, however, there was still a small amount of current at the site. The channel was very steep sided and dropped off quickly, with almost no macrophyte cover in the minor littoral area. There was heavy deposition of organic material and extensive sediment deposition in this area that consisted primarily of silt/clay (<0.5 mm).

The erosional site was located approximately 250 ft upstream of the depositional site, in the first riffle area above the reservoir. It was a bedrock/boulder/cobble riffle with a high gradient and swift velocity. The sampling site was located in the riffle tail, where the substrate was small enough (cobble) to sample with the Surber.

## Reference Reach 1

This reach extended from the outlet of Soda Reservoir downstream to the diversion return located between Hooper Springs and the Monsanto non-contact cooling water outfall.

Nearly 100% of the discharge from Soda Reservoir was diverted at the Soda Reservoir outlet to a diversion canal for Powerhouse #4. The natural streambed below the reservoir contains water from inflow springs, beginning as a slow trickle that increases in volume downstream, as the inflows occur.

Within this reach the stream is approximately three to five feet wide and less than one-foot deep. There was a very low volume of flow in this reach and the natural channel was much smaller and narrower than the reaches upstream of the reservoir. Throughout the reach, most of the stream width had a heavy macrophyte cover. This cover consisted primarily of floating-leaved aquatic plants that were rooted in the stream bank, but cover most of the stream channel. There was heavy sediment deposition in all low velocity areas, including the entire stream width peripheral to the thalweg channel. Most of the flow velocity is in the stream thalweg, creating a narrow central channel with lesser sediment deposition and some exposed gravels.

The two sampling sites were located upstream of Hooper Springs, in a section of the stream which was typical of the reach. The depositional sampling site SCC-1 was located upstream of the Hooper Springs inflow in a small backwater area located near Hooper Springs Park. The erosional site was immediately upstream of the depositional site and was situated in the stream thalweg, that was free of macrophytes.

# Sample Reach 1

This reach extended from the Monsanto outfall downstream to a tributary inflow (Mormon Springs). The upper reach boundary also corresponds to the headworks of the diversion #2 which diverts the entire flow of Soda Creek to a second irrigation/powerhouse canal.

The stream within this reach has a width of two to four-feet and a depth of less than one-foot. This reach has a very low flow volume with water in the natural channel coming from groundwater inflows. Sample Reach 1 had numerous meanders and one inflow channel located upstream of Mormon Spring. The stream channel was narrow and almost completely covered by floating-leaved aquatic macrophytes. There was considerable deposition of fines throughout the channel. Some sections of the channel thalweg with slightly higher flow velocities consisted of a narrow strip of gravel/sand surrounded to the periphery with fines and macrophytes.

The depositional sampling site (SC-1) was located immediately upstream of the Mormon Spring inflow channel in an area of sediment deposition that was free of macrophytes. The erosional sampling site was located in the stream thalweg immediately upstream. The sediments at the depositional sampling site were sandy.

# Sample Reach 2

This reach extended from the Mormon Springs inflow channel downstream approximately 1,000 feet.

The habitat within Sample Reach 2 was the same as that in Sample Reach 1. Both sections were fairly short segments of meandering stream, separated by the inflow of Mormon Springs.

The depositional sampling site (SCC-2) was located upstream and around the first meander bend from the lower reach boundary. It was situated in an area of heavy sediment deposition that did not have significant macrophyte cover. The erosional site is located immediately upstream, in the channel thalweg. As in Sample Reach 1, the sediments were sand-sized particles.

## Sample Reach 3

This reach extended from the bottom of Sample Reach 2 (Reach 2) downstream to the Soda Springs Town limits.

This reach had a very low flow volume with habitat similar to Sample Reaches 1 and 2. The stream channel was noticeably less meandering with a lesser amount of sediment deposition than in Sample Reaches 1 and 2. The stream was almost completely covered by emergent and submergent (floating-leaved) plants that were rooted along the sides of the thalweg. The fines were more to the periphery of the thalweg than in Sample Reaches 1 and 2. There was a noticeable thalweg channel with gravel/cobble substrate and occasional small boulders, that occurred over a broader area than in Sample Reaches 1 and 2. As in Sample Reaches 1 and 2, there was no riffle habitat or any areas deep enough to comprise pool habitat.

The depositional sampling site is located just upstream of the lower reach boundary. There are no good areas of sediment deposition which are also without macrophyte cover. The sampling site is in very shallow water with cover from short, grass-like macrophytes. The erosional site is located immediately upstream in the thalweg channel.

# Sample Reach 4

This reach extended from a point beginning 300 ft downstream of the Reach 3 lower boundary to the Powerhouse #5 diversion return. The short section (approximately 300 ft) omitted from the reach designation process consisted of a long, straight bedrock run with a higher gradient than either Sample Reach 3 or 4. It was both brief and considered atypical.

There was very low flow volume and habitat in this reach similar to Sample Reach 3 with a somewhat wider thalweg channel. There were no portions that could be classified as true riffle habitat. Deposition of fines occurs to the periphery of the thalweg channel. The gradient in Sample Reach 4 was slightly higher than in Sample Reach 3.

The depositional sampling site (SC-4) was located immediately upstream of the lower reach boundary in a wider, deeper pool section. The erosional site was located immediately upstream in the thalweg channel.

# Sample Reach 5

This reach extended from the Powerhouse #5 discharge downstream to the headworks of Soda Canal.

This was the first reach downstream of Soda Reservoir to carry the full discharge of the creek system. It is the reach with the highest flow volume, and the channel is full in places to the top of the banks. Habitat types included long sections of deep run habitat interrupted by regular riffle areas with some backwater habitat.

The channel is wider and better defined than Sample Reaches 1 to 4 due to the high flow rate. This stream was approximately five- to ten-feet wide with a depth of three- to five-feet in the thalweg. Despite the higher discharge there was still considerable deposition of fines along the periphery of the stream thalweg and an extensive macrophyte cover along the stream periphery that occasionally extended the width of the stream. The aquatic macrophytes present in this reach are primarily submergents, with few of the emergents and floating-leaved plants that were observed in Sample Reaches 1 to 4. The thalweg channel for the most part was free of macrophytes and consisted of a mixture of gravels/fines for substrate. Riffle-like hydraulic control sections occur regularly which are dominated by boulders together with submergent macrophytes.

The depositional sampling site (SCC-5) was situated in a shallow area between the bank and a small vegetation island, located well upstream of the lower reach boundary. This area was selected because of the lesser development of macrophyte cover. The erosional sampling site was located immediately downstream of a bridge crossing in a small gravel patch at the periphery of a riffle area.

# Sample Reach 6

This reach extended from the Soda Canal diversion downstream to the upstream side of the railway crossing culvert (Figure 4-1).

At the time of sampling a small (approximately 10%) portion of the Soda Creek flow was being diverted into Soda Canal. Therefore, Sample Reach 6, like Sample Reach 5, had a high flow rate, although not bankfull. This reach had a moderately high gradient and swift flow velocity similar to Sample Reach 5.

The habitat in Sample Reach 6 is similar to Sample Reach 5, with deep/fast run habitat and regular riffle areas and backwater habitat. There was heavy deposition of fines along the periphery of the thalweg with extensive development of submerged macrophytes along the periphery and, in places, throughout the stream width. Riffle areas were dominated by boulders with complete coverage by macrophytes.

The depositional sampling site (SC-6) was located upstream and around a bend from the lower reach boundary in a small backwater pocket. The backwater area was largely macrophyte free and shallow enough to sample. The erosional site was difficult to locate due to the depth and velocity of the thalweg channel. It was located well upstream (~650 ft) of the deposition site in the thalweg channel at a spot that was shallow enough to sample.

## Sample Reach 7

This reach extended from the railway crossing culvert (Figure 4-1) downstream to the creek mouth (confluence with Alexander Reservoir).

This reach had the same flow volume as Sample Reach 6 with similar habitat characteristics. It was dominated by deep/swift run areas with regular riffle sections. There was no distinct pool habitat, but some areas of backwater habitats were present, particularly on meander bends. There was heavy deposition of fines along the thalweg periphery and in backwater areas with a well developed cover of submerged macrophytes. Riffle areas were dominated by boulders and were completely covered by submergent macrophytes.

The depositional sampling site (SC-7) was located in a backwater pocket on the first bend upstream of the creek mouth. The erosional sampling site was located upstream (~ 150 ft), in the first area in the thalweg channel that was shallow enough to sample.

# 5.2.1.2 Data Analysis

Depositional areas of Soda Creek supported 11,000 to 102,000 invertebrates per square meter. A total of 33 taxa were identified from depositional sites. As in the reservoir, the benthic fauna was dominated by oligochaete worms and chironomid midge larvae, which collectively accounted for 97.3% of mean total invertebrate density. Taxonomic richness (number of taxa encountered) at individual sites ranged from means of 4.3 to 5.7 at the reference sites and from 6 to 10.3 at the sample sites.

The MANOVA showed significant differences in the means (of the  $\log_{10}$  transformed data) of the benthic invertebrates, total invertebrates and taxa between the Soda Creek sample stations (p < 0.0001). Since both the sediment chemistry and benthic community show significant differences between the Soda Creek sample stations, a canonical correlation analysis (CCA) is performed to determine if there is a significant relationship between the metal concentrations and benthic fauna.

The CCA used the  $\log_{10}$  transformations of Tubificidae, Tantytarsini, Orthocladiinae, Chironomus sp., Tanypodinae, and total invertebrates together with the number of taxa. The first set of canonical covariates had a squared canonical correlation of 0.84 (p < 0.0001) and the second canonical covariates had a squared correlation of 0.66 (p = 0.0189). The other sets of canonical covariates were insignificant.

Table 5-11 shows the canonical coefficients for the first two sets of canonical covariates. The first set of canonical covariates is dominated by Tubificidae, Total Invertebrates, silver and vanadium. As the concentration of silver increases, the number of Tubificidae decrease but the total number of invertebrates increase. Conversely, as the concentration of vanadium increases, the number of Tubificidae increase but the total number of invertebrates decrease. The second set of canonical covariates are dominated by Tanytarsini, number of taxa, cadmium, nickel, and vanadium. As the concentration of cadmium and vanadium increases, the number of Tanytarsini and taxa increase, while as the concentration of nickel increases, the number of Tanytarsini and taxa decrease. These canonical covariates do not lead to a clear physical or ecological interpretation of the relationship.

To examine the statistical relationships developed by the CCA relative to the Soda Creek stations, the canonical covariates are plotted using symbols to distinguish the different stations. Figures 5-21 and 5-22 show the plots of the first and second sets of canonical covariates, respectively. As seen in Figure 5-21, the first set of canonical covariates separates stations SC-6 and SC-7 from the other stations. The remaining stations, both sample and reference, are in no distinguishable groupings. As seen in Figure 5-22, the second set of canonical covariates separates station SCC-1 from all the other stations, which do not show any distinguishable groupings.

The most striking result of the first set of canonical covariates is the large separation of sites SC-6 and SC-7 from the other sites on Soda Creek. Both of these sites get large negative metal canonical covariates because of the relatively high concentrations of silver and relatively low concentrations of vanadium and copper. However, the large negative benthic canonical covariates for these two sites are not based on the same benthic fauna. At site SC-6, the large negative benthic covariate is due to relatively small number of Tubifieidae at this site. However, site SC-7 has a large negative benthic covariate due to the large total number of invertebrates at that site, which is dominated by Chironomini (two orders of magnitude greater than at any other site). Thus, these two sites, with similar metal concentrations have very different benthic communities, and both of these benthic communities are very different from all the other sites.

The second set of canonical covariates separates the reference site SCC-1 from all the other sites. The large negative metal canonical covariate is due to the relatively high concentration of nickel at this reference site and the low concentration of all other metals. The large negative benthic canonical covariate is due to the absence of Tanytarsini, the relatively small number of taxa and the large number of total invertebrates (almost all of which are Tubificidae).

The CCA has in essence shown that sites SCC-1, SC-6 and SC-7 have different benthic communities than the other sites. It has associated these differences with linear combinations of the metal concentrations at those sites which will also distinguish them from the other sites. However, these differences can also be due to changes in habitat that are unrelated to the metal concentrations and the association with the metal canonical covariate is an artifact of the CCA.

To determine if the relationship between metal concentrations and benthic fauna is due solely to these three unusual sites, the statistical analysis was performed again with these three sites removed. The MANOVA results again showed that there was significant differences in the metal concentrations (p<0.0001) and benthic fauna (p=0.0127) between the remaining stations. However, the CCA shows no significant relationship between the benthic fauna and metal concentrations because the significance level of the first set of canonical covariates is p=0.2627.

Therefore, while there are significant differences in the benthic fauna and metal concentrations at sample stations, the CCA shows that there is no association between benthic fauna and metal concentrations. The significance shown in the CCA using all the sample stations is due to the unusual benthic communities at SC-6, SC-7 and SCC-1, which are unrelated to the metal concentrations.

Erosional sites (Table 5-12) were characterised by slightly more diverse but less abundant invertebrate communities. Total taxa at these sites amounted to 22 with 9 and 12 taxa at two the reference sites and 7 to 13 taxa at the sample sites. Total invertebrate density was 17,800 and 19,400 and similar at the reference sites, but varied greatly at the sample sites (2,800 to 38,800). The benthic fauna of erosional sites was also dominated by oligochaete worms and chironomids that accounted for approximately 82% of total invertebrates, but also included mayfly nymphs, caddisfly larvae, leeches, amphipods and other taxa at lower densities. Densities of each taxon varied greatly among sites and as a consequence, consistent differences between the control and sample sites were absent.

## 5.2.2 Alexander Reservoir

The benthic invertebrate sampling sites were located in the two eastern arms of the reservoir (Figure 4-1). Sites were characterised by 1.5 to 5 feet depth and soft mud substratum. Aquatic plants were absent from the areas sampled. All reservoir sites were located in comparable habitats.

The bottom fauna of Alexander Reservoir was dominated by oligochaete worms (mostly Tubificidae) and chironomid midge larvae (especially *Chironomus*), which collectively accounted for means of 98.3 and 99% of total invertebrates at the control sites and below Soda Creek, respectively. Total invertebrate density ranged from 1,600 to 8,300 individuals per square meter at the control sites, compared with 3,800 to 27,800 individuals per square meter in the reservoir arm below the inflow from Soda Creek. Taxonomic richness (total number of taxa) in the control sites and sample sites had mean values of 7.9 and 9.3, respectively.

The MANOVA was insignificant (p=0.5115), thus the null hypothesis of equality of means (of the  $log_{10}$  transformed data) of the groups is not rejected. There is no statistical evidence of a difference in the benthic fauna across all the groups. It should be noted, that the MANOVA was actually run on several different transformations of the data and included all the benthic invertebrates, in all cases the MANOVA showed no significant differences. Additionally, the univariate ANOVAs also showed no statistical evidence of a difference in

the benthic fauna across all the groups. Therefore, the sediment chemistry in Alexander Reservoir is not associated with any changes in the benthic fauna.

# 5.3 Toxicity Testing

The sediment toxicity test data for each sample taken at each site is provided in Attachment I and Table 4-1 provides a summary of samples used for toxicity statistical analysis and those not used due to the presence of leaches. Table 5-13 shows the mean and standard deviation for the percent mortality and dry weight (mg/organism) for each sample station or group in the creek and the reservoir. The dry weight result was derived from those organisms that were alive at the end of the ten days.

For sediment samples collected in Soda Creek the nested ANOVA showed no significant difference (p=0..2928) between the mean percent mortality of the locations (which includes the laboratory controls). However, the nested ANOVA showed a significant difference (p=0.0009) between the mean dry weight per organism at the locations. The multiple comparison test showed the primary significant difference is the dry weight of the laboratory controls which is significantly smaller than the dry weights at at the reference stations SCC-3 (p< 0.001), SCC-2 (0.01 < p < 0.05) and SSC-1 (0.001 < p < 0.01), and test station SC-6 < p < 0.001). Additionally, test stations SC-2 (0.01 < p < 0.05) and SC-4 (0.01 < p < 0.05) had significantly lower growth than reference site SCC-3).

To determine if there was a significant association between the sediment chemistry and growth in Soda Creek, a multiple regression was performed. The growth was corrected for the differences in the laboratory controls. The multiple regression was insignificant (p>0.05), which indicates the differences in growth are not associated with sediment chemistry.

For sediment samples collected in Alexander Reservoir the nested ANOVA showed a significant difference (p=0.1465) between the mean percent mortality of the locations. However, the nested ANOVA showed a significant difference (p≤0.0001) between the mean dry weight per organism of the locations. Table 5-14 shows the significant pairwise differences in mean dry weights from Tukey's multiple comparison tests. As seen in Table 5-13, Groups 2 (ARS-4, 5, and 6) and 3 (ARS-7, 8, and 9) have a significantly lower dry weight than the reference samples.

The multiple regression of the sediment chemistry on the growth for Alexander Reservoir was highly significant (p <0.001). However, the chemical concentrations in Alexander Reservoir sediments are not as high as those in the Soda Creek sediments. This indicates that the lack of growth (i.e. lower dry weight) may be due to lack of suitable food, rather than metal toxicity.

## 6. DISCUSSION

To evaluate sediment quality in Soda Creek and Alexander Reservoir an effects-based approach has been adopted, rather than rely on surrogate sediment quality guidelines (e.g., Ecology 1991). The effects-based approach for this study will incorporate the measures of sediment chemistry, sediment toxicity, and benthic community structure, also known as the sediment quality triad (Triad) approach (Chapman 1992). The Triad approach is intended to allow for (1) interaction between constituents in complex sediment mixtures (e.g., additivity, antagonism, synergism), (2) potential actions of unidentified chemicals, and (3) effects of environmental variables that may influence biological responses (e.g., toxicant concentrations and bioavailabity) (Chapman 1992). The three components of the Triad approach provide complementary data for a site-specific ecological assessment of endpoints that are relevant to the evaluated ecological resources (Soda Creek and Alexander Reservoir. In this study, the Triad data have been evaluated using analysis of variance, and canonical correlation analysis to determine if there are any consistent and significant relationships among the data.

Sediment quality guidelines depend on chemical measures and anticipated effects to ecological resources. The chemical measures incorporated into sediment quality guidelines do not adequately integrate the site-specific effects that sediment conditions (e.g., grain size, organic content, pH, oxidation-reduction state, chemical form, etc.) have on toxicity. In addition, the ecological effects evaluated using sediment quality guidelines are unknown and may be inappropriate for the evaluated system. Consequently, sediment quality guidelines developed for other localities are not appropriate for this assessment of Soda Creek and Alexander Reservoir.

## 6.1 Soda Creek

The mean concentration (clay-weight basis) of arsenic, copper, nickel, selenium, and vanadium are significantly elevated at some downstream sample stations in Soda Creek compared to the reference sample stations. However, for these metals the farthest downstream sample station for Soda Creek (SC-7) is not significantly different from one or more of the reference stations. Only cadmium and silver have significantly different mean concentrations at all sampling stations relative to the reference stations. Silver is not detected in either the Monsanto non-contact cooling water or groundwater from Mormon Springs

Spatial trends in concentration show two principal areas where these metals are accumulating relative to reference samples: (1) 2,000 to 5,000 feet and (2) 9,000 to 13,000 feet downstream of the diversion dam on Soda Creek. Non-contact cooling water is not a likely source for elevated metal concentrations in sediments found in either zone of accumulation. Non-contact cooling water from Monsanto does not actually enter Soda Creek until passing through the powerhouses located approximately 5,000 to 6,000 feet downstream of the diversion dam on Soda Creek. The spatial distributions of metal concentrations do not show peaks that would be associated with the powerhouse return

flow. Metal accumulations in the first area are probably related to groundwater discharges from Calf/Mormon Springs, which enters Soda Creek approximately 1,500 feet downstream of the diversion dam on Soda Creek. The source of metals for the second area of accumulation is unknown, but may be related to other sources of discharge within the City of Soda Springs not related to the Monsanto facility. No additional outfalls were identified during these field studies.

The numbers of organisms found in Soda Creek sediments ranged from 11,000 to 102,000 invertebrates per square meter. The benthic fauna at all stations (sample or reference) was dominated by oligochaetes and chironomids. The taxonomic richness was slightly higher at sample sites relative to the reference sites. The dominance of the benthic community by oligochaetes and chironomids is characteristic of depositional habitats with a potential for oxygen depletion in the sediment (Wiederholm 1984) and are indicative of low quality aquatic habitat that receive high loadings of organic material or nutrients.

MANOVA showed there were significant differences in the means of (1) different benthic invertebrates, (2) total numbers of invertebrates, and (3) number of taxa at the stations. Canonical correlation analysis showed that there were significant differences in the benthic fauna at three sites: SCC-1, SC-6 and SC-7. The association of the significant differences in benthic fauna with metal concentrations in the sediments appear to be artifacts of the CCA. When the statistical analyses is reported with these three sites removed, there is no significant association between benthic fauna and metal concentrations. Since these seven remaining sites include two of the reference stations and the sample stations with the highest metal concentrations, there is no significant adverse effect of metal concentrations on the benthic community.

Toxicity testing showed there was no significant difference in percent mortality between reference and sample stations. The only significant difference found for organism growth was between two sample stations (SC-2 and SC-4) and one reference station (SCC-3). There was not a significant association between the sediment chemistry and growth.

For Soda Creek, it has been shown that there are elevated levels of metals in sediments, but there has been no meaningful alteration of the benthic community structure that can be attributed to the presence of those elevated concentrations. In addition, the sediments do not exhibit toxicity to the types of organisms naturally-occurring in the sediments. Based on the Triad approach, the preponderance of evidence shows there has not been a significant impact to the benthic community structure.

## 6.2 Alexander Reservoir

The highest concentrations of metals are found in the group of sample stations located closest to the mouth of Soda Creek. Spatial trends indicate decreasing concentrations with increasing distance from Soda Creek. The metal concentrations in sample stations at the mouth of Soda Creek are significantly higher than metal concentrations in the reference samples. Thus, there are elevated metal concentrations in Alexander Reservoir that can be

attributed to Soda Creek. However, the metal loading from Soda Creek is rapidly attenuated in the reservoir, because of the low sediment load from Soda Creek.

As in Soda Creek, the benthic fauna at both the reference stations and sample stations in Alexander Reservoir are dominated by oligochaetes and chironomids, again indicating a low quality depositional aquatic habitat subject to oxygen depletion and high loadings of nutrients and organic material. This would not be unexpected since sediment samples were collected from depths less than 5 feet below the water surface. These sites could be exposed during reservoir drawdowns, which would result in stress to the organisms. Therefore, only stress-tolerant organisms would be expected to inhabit these locations. There was no statistically significant difference between benthic community structure between any sample group and the reference group, indicating that elevated metal concentrations have not altered the community structure.

Toxicity testing showed no significant differences in percent mortality between the reference group and the sample stations. There was, however, a significant difference in growth between the reference group and the two groups of samples stations that were located closest to the mouth of Soda Creek.

For Alexander Reservoir, there are elevated concentrations of metals in sediments collected near the mouth of Soda Creek. The presence of these metals has not resulted in an alteration of the benthic community structure. Toxicity testing shows that there is stress (i.e., lower growth) but not acute mortality resulting from exposure to toxic chemicals. It is difficult to attribute the observed toxic response to the presence of metals in the sediments because the response did not occur in the sediments with the highest metal concentrations, in Soda Creek.

### 7. SUMMARY AND CONCLUSIONS

Analysis of the Soda Creek sediment samples show the following:

- The benthos in both the reference and sample areas of Soda Creek are dominated by species that are indicative of a "low quality" stream system. Therefore, alterations to the benthic community structure are not considered a significant ecological impact.
- There is no significant difference in the percent mortality in toxicity tests of the test sediment samples as compared to the reference sediment samples. The dry weight of the organisms at the end of the toxicity tests were significantly lower for two test stations (SC-02 and SC-04) as compared to the reference station SCC-3. However, there was no significant association between growth and chemical concentrations.
- The benthic communities at the two sample stations farthest downstream of the diversion dam (SC-06 and SC-07) and at the reference station immediately upstream of the diversion dam SCC-01 have a different structure from the other stations. These differences appear to be due to local hydrologic phenomena rather than differences in metal concentrations. When these sites are removed from the analysis, the remaining seven sites (including two reference sites and the sample sites with the highest metal concentrations) do not show a significant change in benthic communities associated with the elevated metal concentrations downstream of the diversion dam on Soda Creek.
- The presence of molybdenum in sediments at sites SC-2 and SC-3 may be attributable to the presence of molybdenum in groundwater (Mormon Springs) which discharges into Soda Creek.
- The mean concentration of arsenic, copper, nickel, selenium and vanadium in the sediments are elevated at some of the sample stations, however, the sample stations farthest downstream are not significantly different from one or more of the reference sampling stations (background). Copper has not been detected in Mormon Springs (two samples) and is not a constituent of interest in groundwater at the site. Copper has also not been detected in the non-contact cooling water samples. In addition, neither arsenic nor nickel have been detected in the non-contact cooling water and were either not detected or detected at very low concentrations in the groundwater (Mormon Springs). Only cadmium has a significant difference in the means of the test station farthest downstream (SC-7) and the reference stations of the constituents detected in the Monsanto non-contact cooling water outfall or discharge from Mormon Springs.
- Other sources within the City of Soda Springs may be responsible for metal accumulation at some sample locations in Soda Creek.

- The benthos in both the reference and sample areas of Alexander Reservoir are dominated by species that are indicative of a "low quality" system. Therefore, alterations to the benthic community structure are not considered a significant ecological impact.
- A significant increase in the concentration of arsenic, cadmium, copper, nickel, selenium, silver and vanadium in sediment samples from the area of the reservoir affected by Soda Creek as compared to the reference area. Of these, only arsenic, cadmium, nickel, selenium, and vanadium were detected in either the non-contact cooling water or groundwater discharge from Mormon Springs. The significance of this increase is greatest closest to the mouth of Soda Creek and decreases with distance from the mouth of Soda Creek, with copper and pH not being significantly different from the control area at the group farthest from Soda Creek.
- There is no significant difference in the benthic community in the sediment samples from the area of the reservoir affected by Soda Creek as compared to the control area.
- There is no significant difference in the percent mortality in toxicity tests of the sediment samples from the area of the reservoir affected by Soda Creek as compared to the reference area.

The results of using the Triad approach show that the presence of elevated metal concentrations in sediments from Soda Creek and Alexander Reservoir have not significantly altered the benthic community structure of either system. In addition, there is no evidence of toxicity in Soda Creek sediments. Sediments from Alexander Reservoir do show evidence of toxicity, however, data suggest that it is not related to metal concentration. Based on these results, no adverse ecological effects have occurred as a consequence of the discharge of non-contact cooling water and natural groundwater discharge containing metals to Soda Creek. Based on this conclusion, there is no need for further sampling of Soda Creek or Alexander Reservoir for the Monsanto RI.

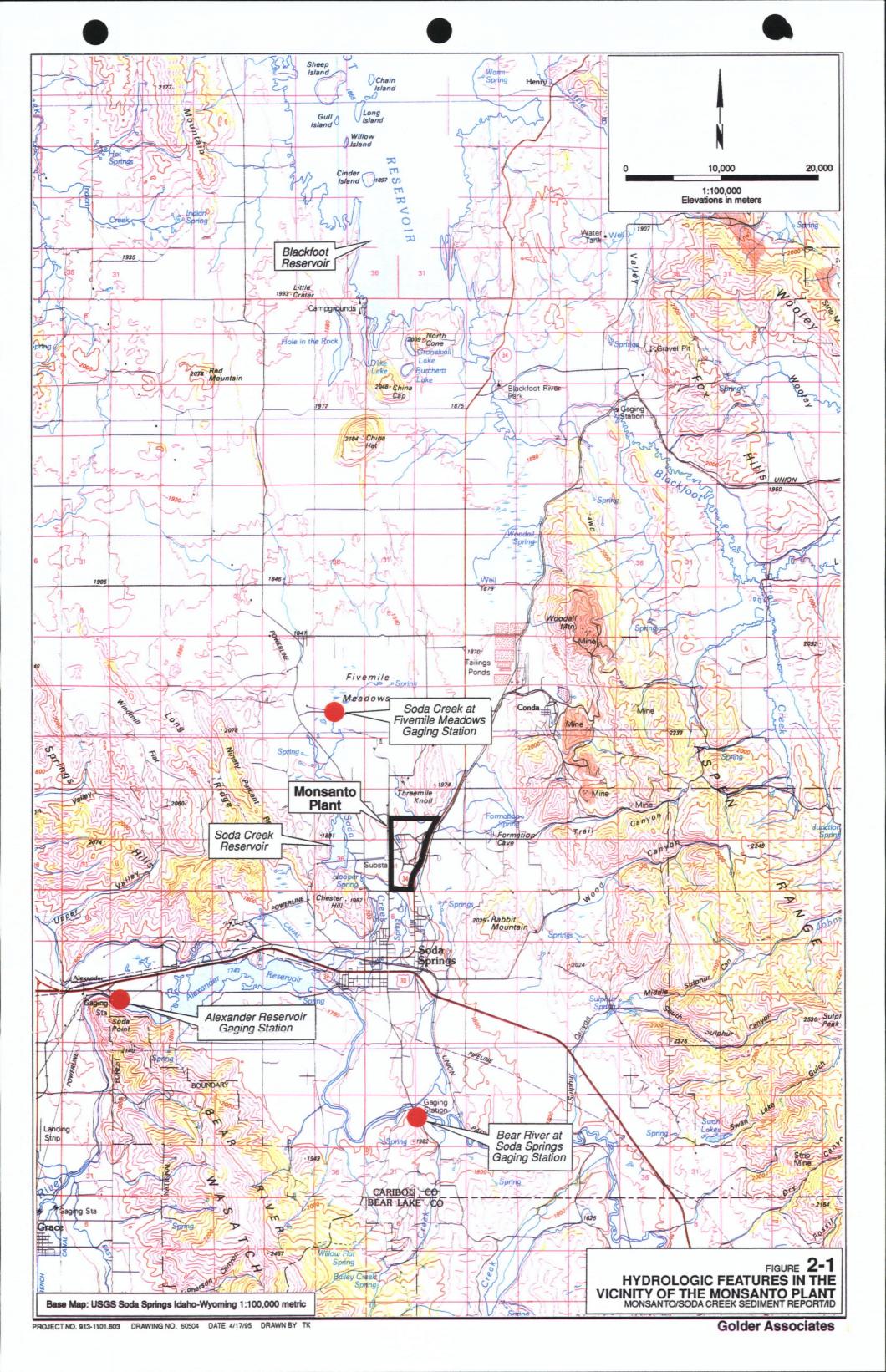
## 8. LITERATURE CITED

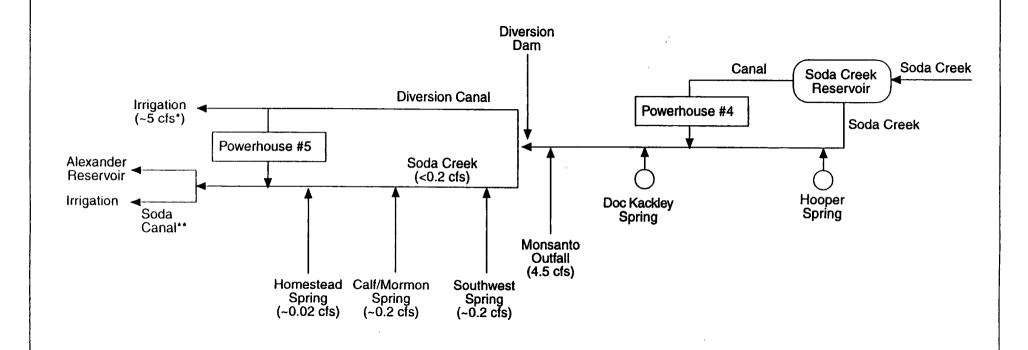
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# **FIGURES**

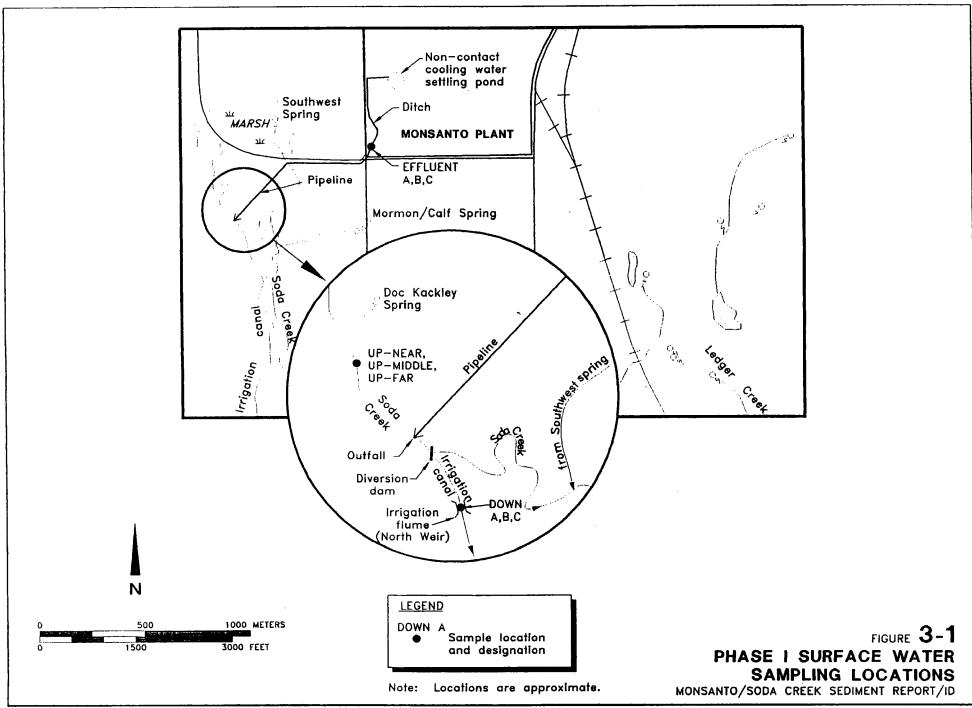


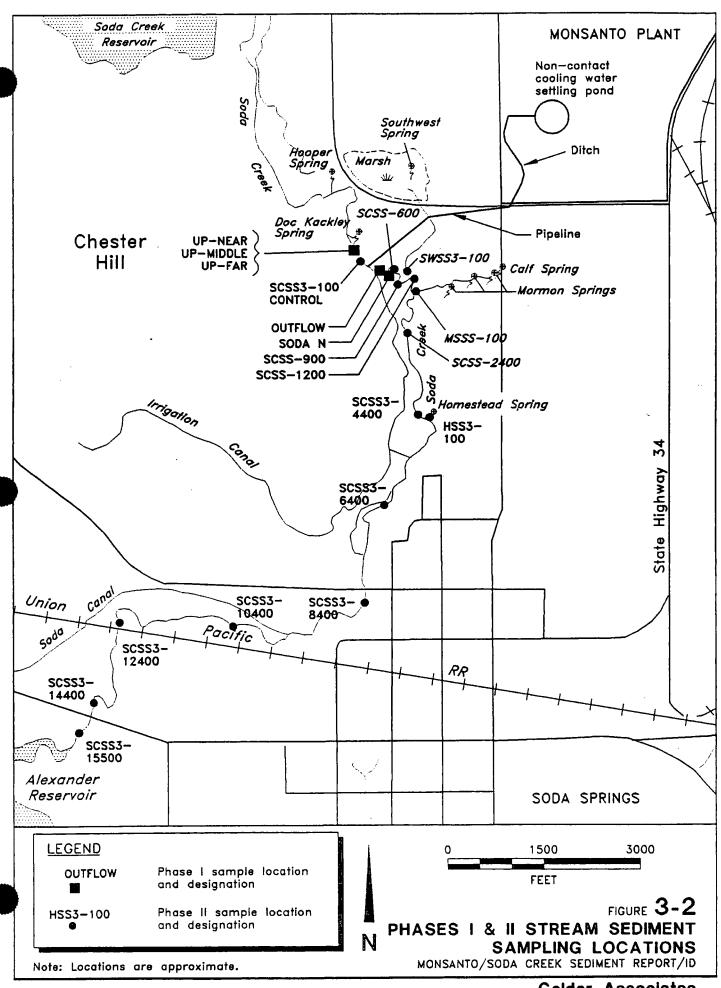


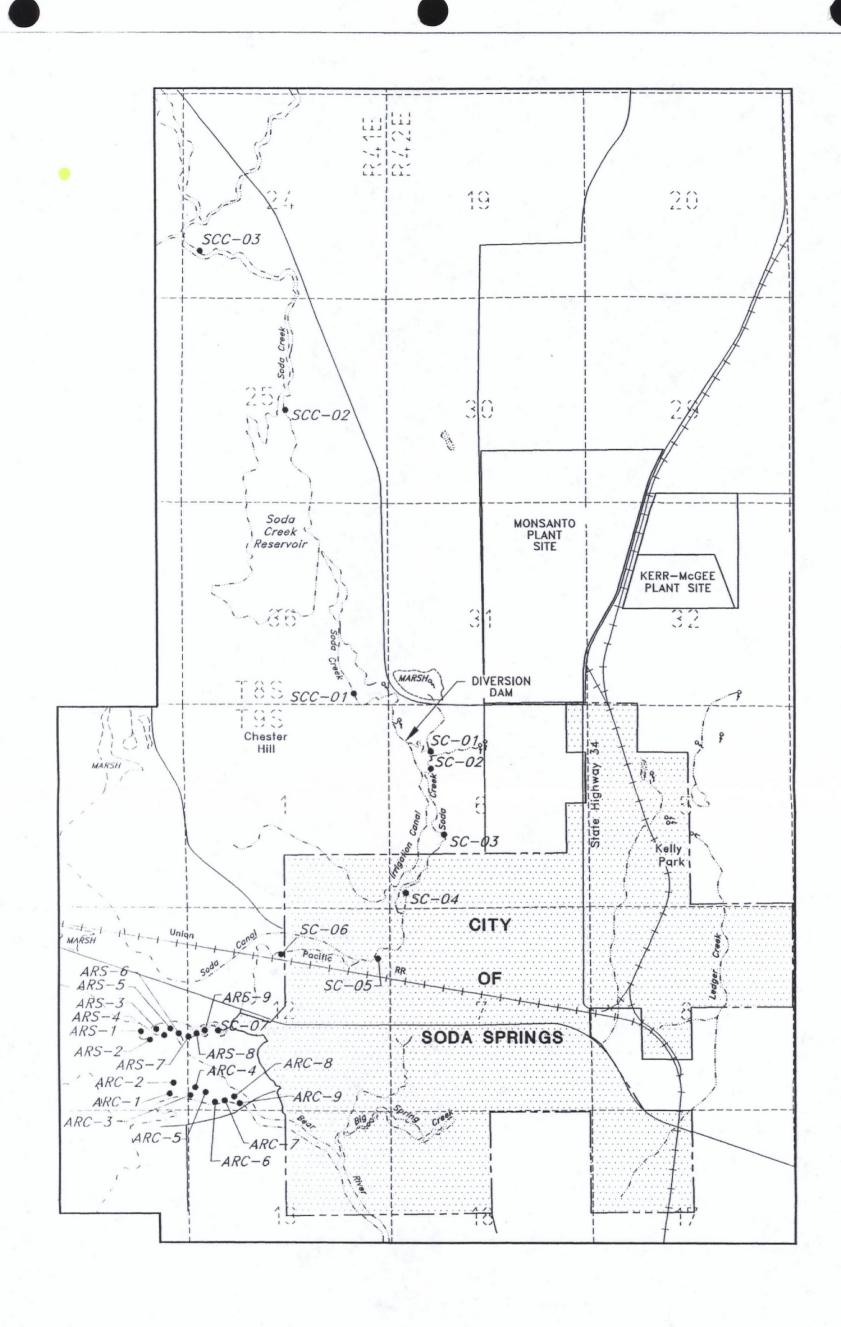
#### **NOTES**

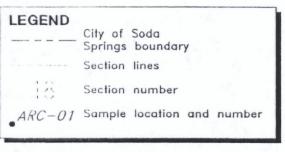
- * Only during 3-4 months of summer
- ** Receives all flow during 3-4 months of summer

FIGURE 2-2
APPROXIMATE FLOW THROUGH THE SODA CREEK STREAM SYSTEM MONSANTO/SODA CREEK SEDIMENT REPORT/ID









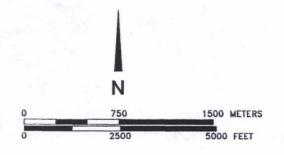
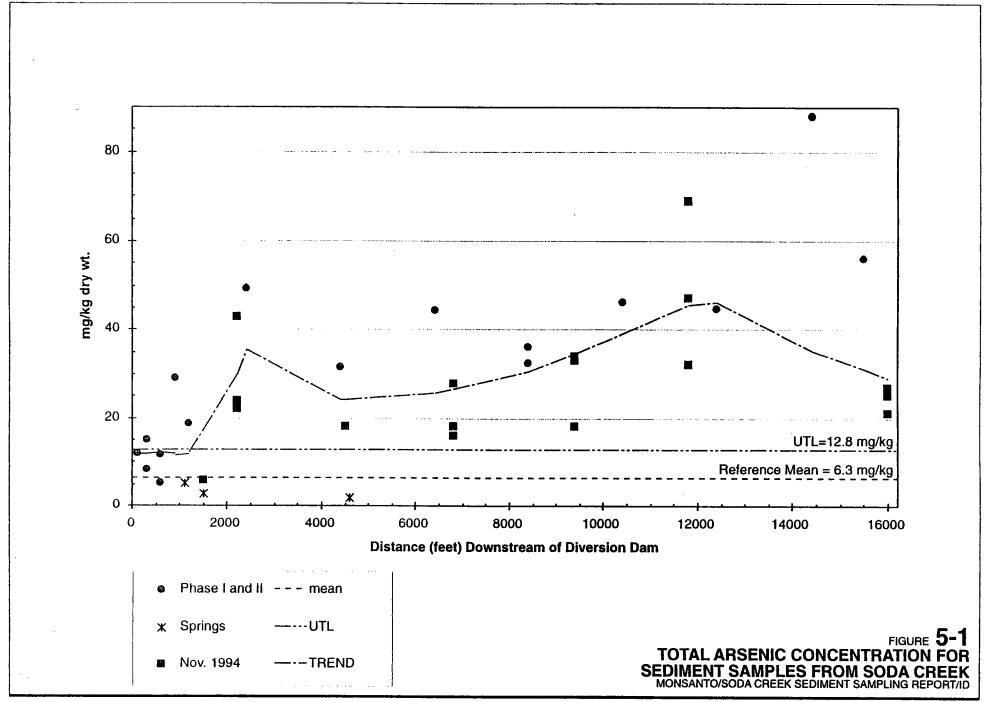
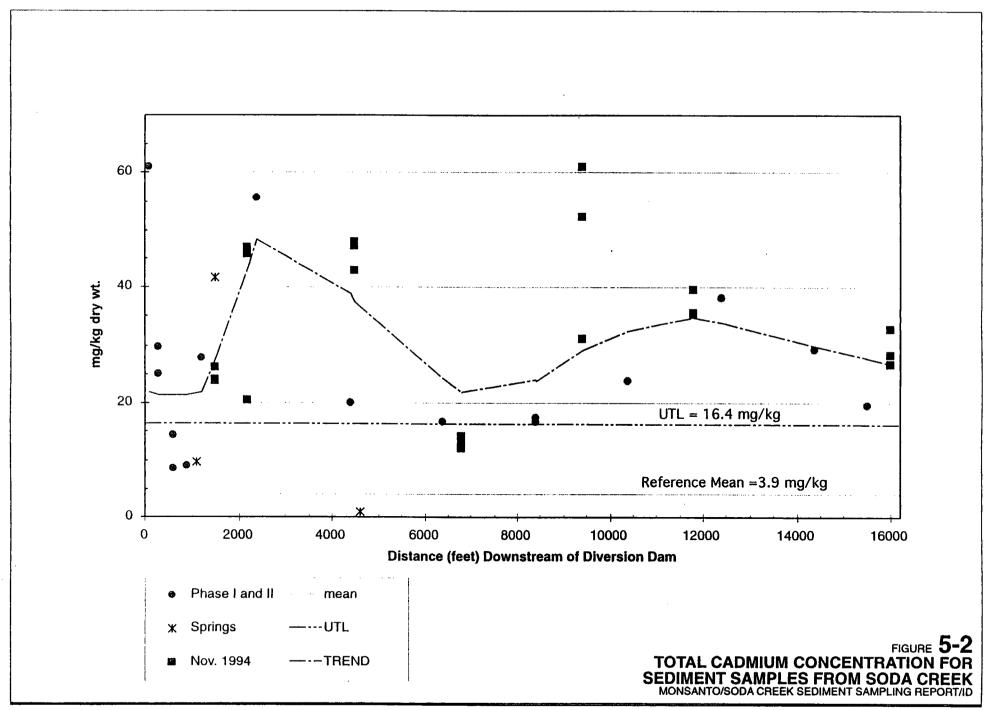
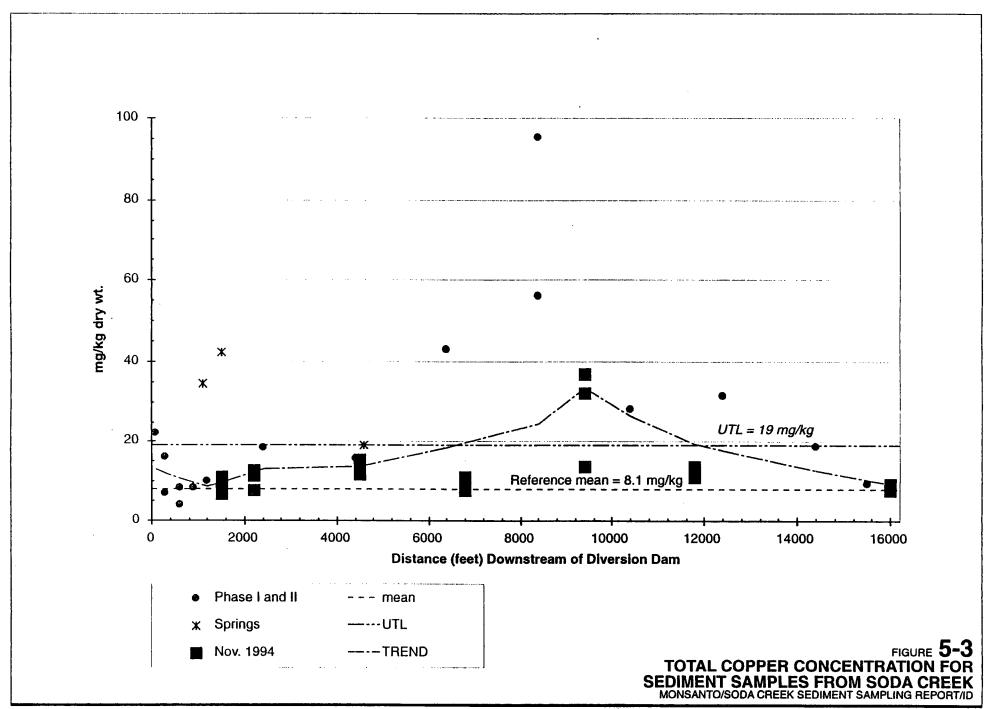
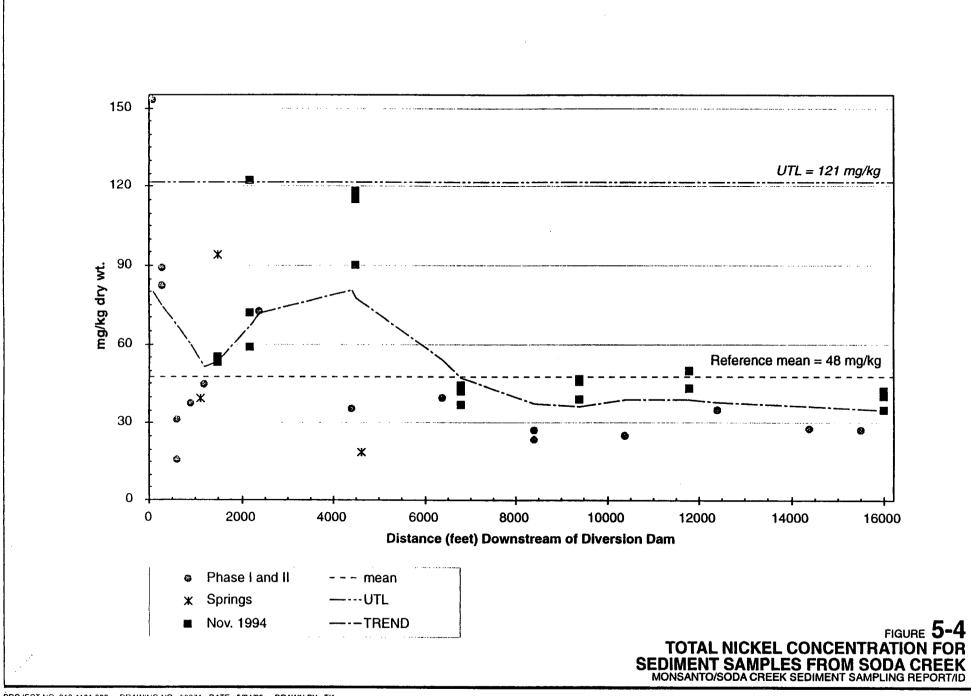


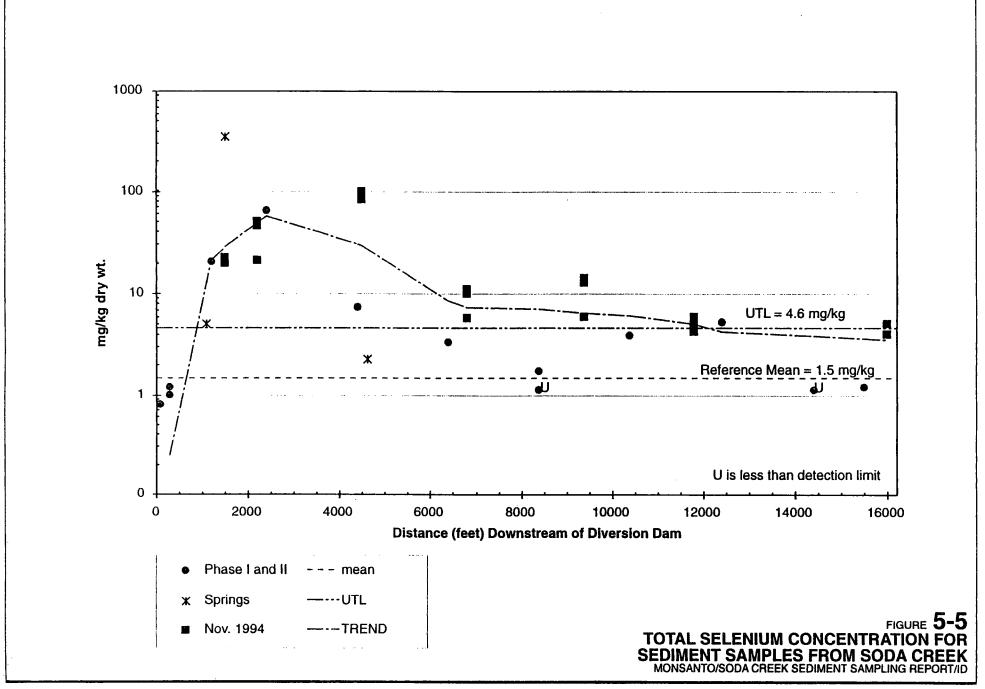
FIGURE 4-1
SAMPLE SITE LOCATIONS
FOR SODA CREEK AND
ALEXANDER RESERVOIR
MONSANTO/SODA CREEK SEDIMENT REPORT/ID

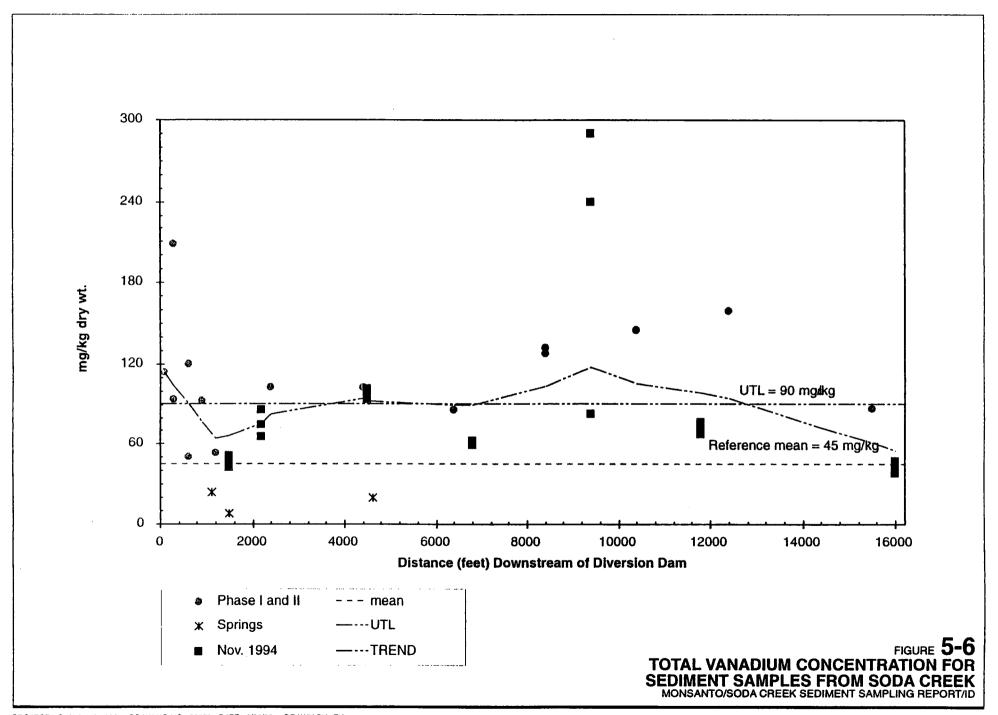


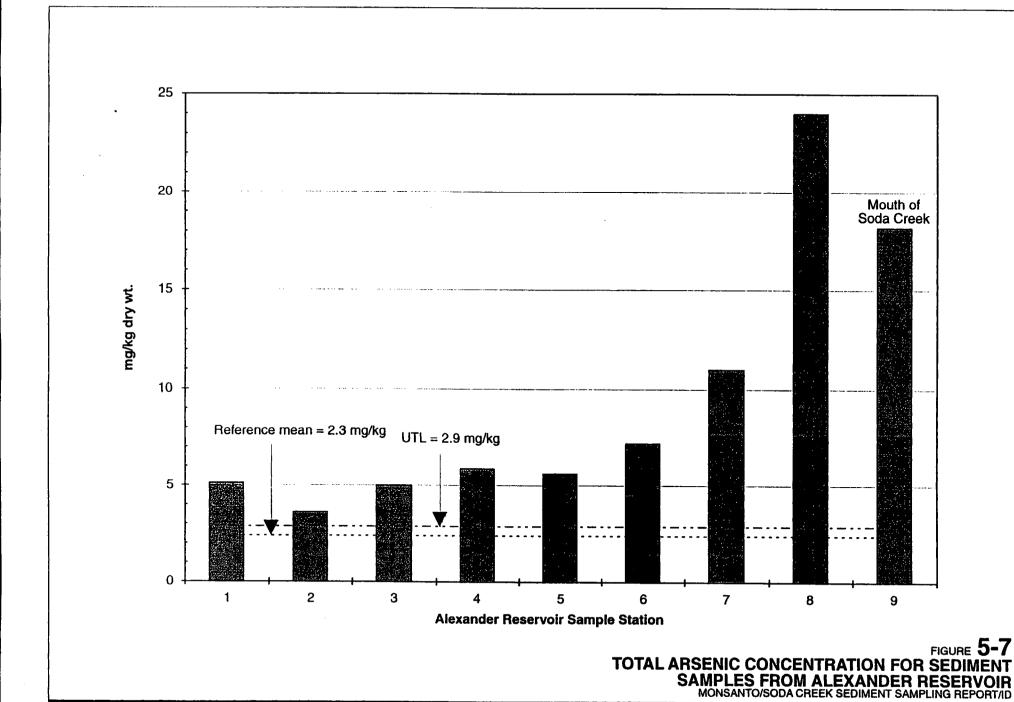


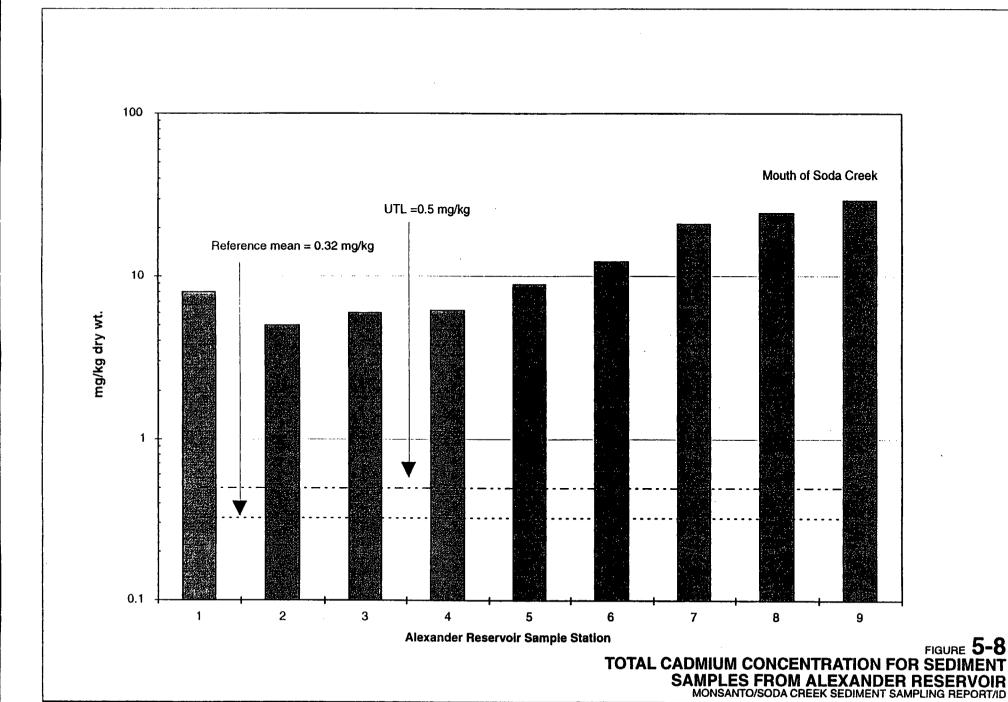


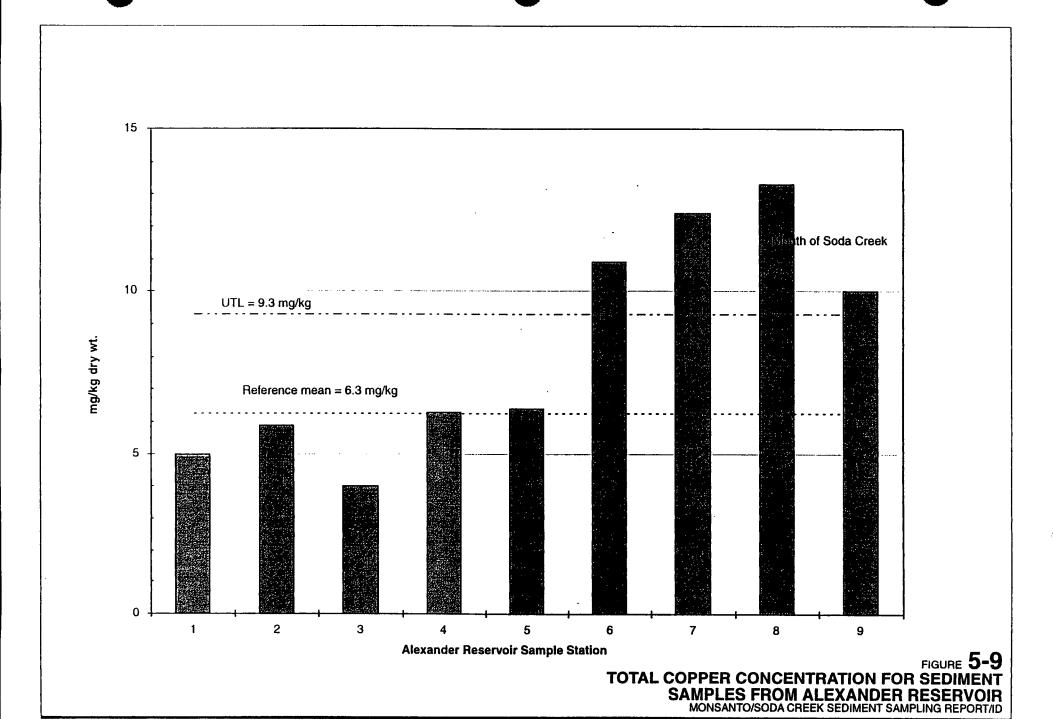


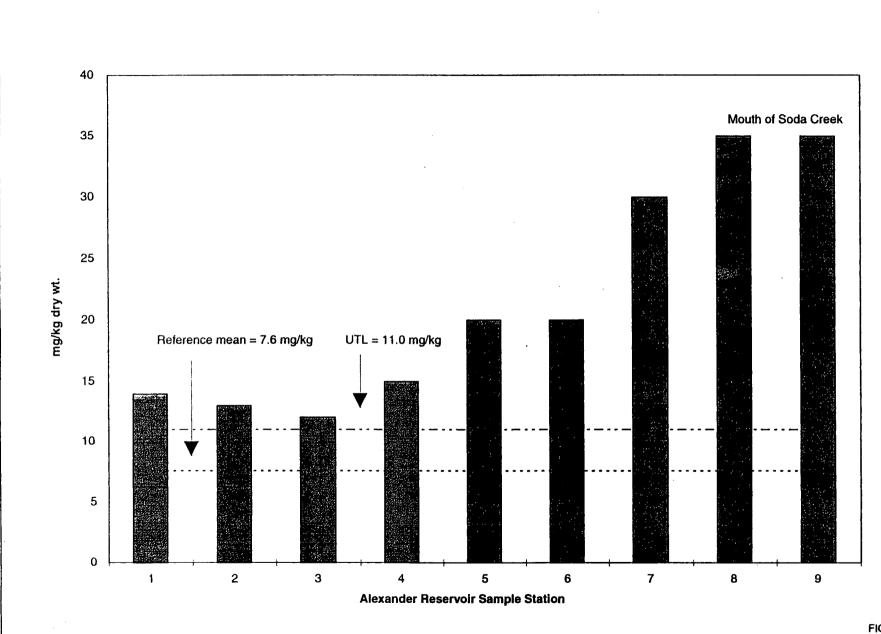




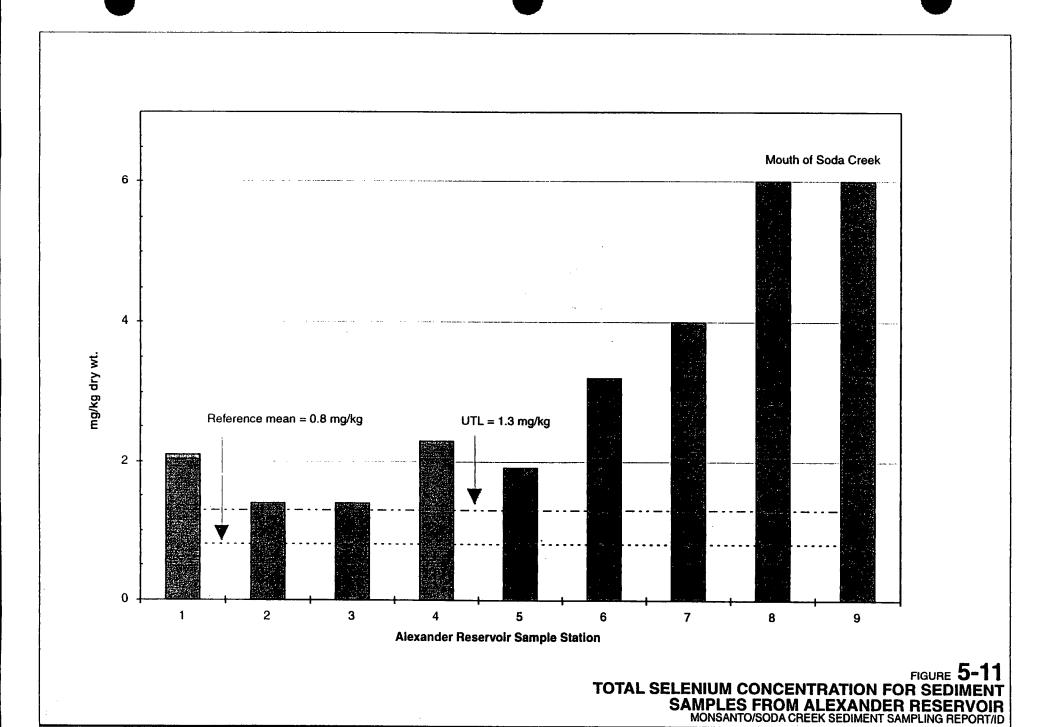


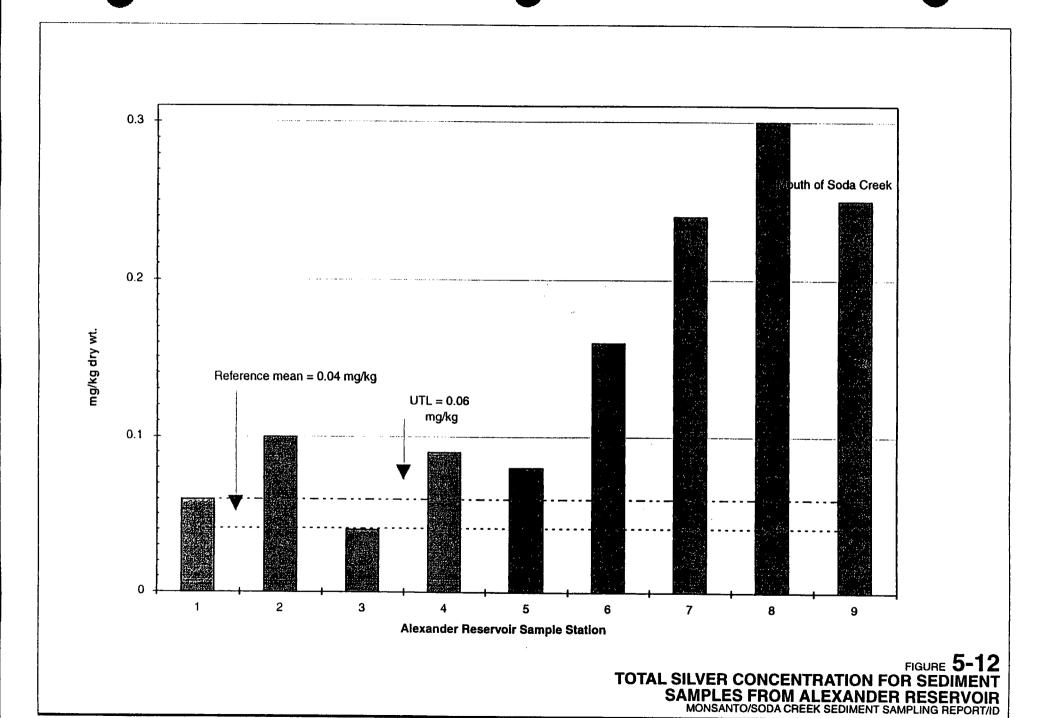


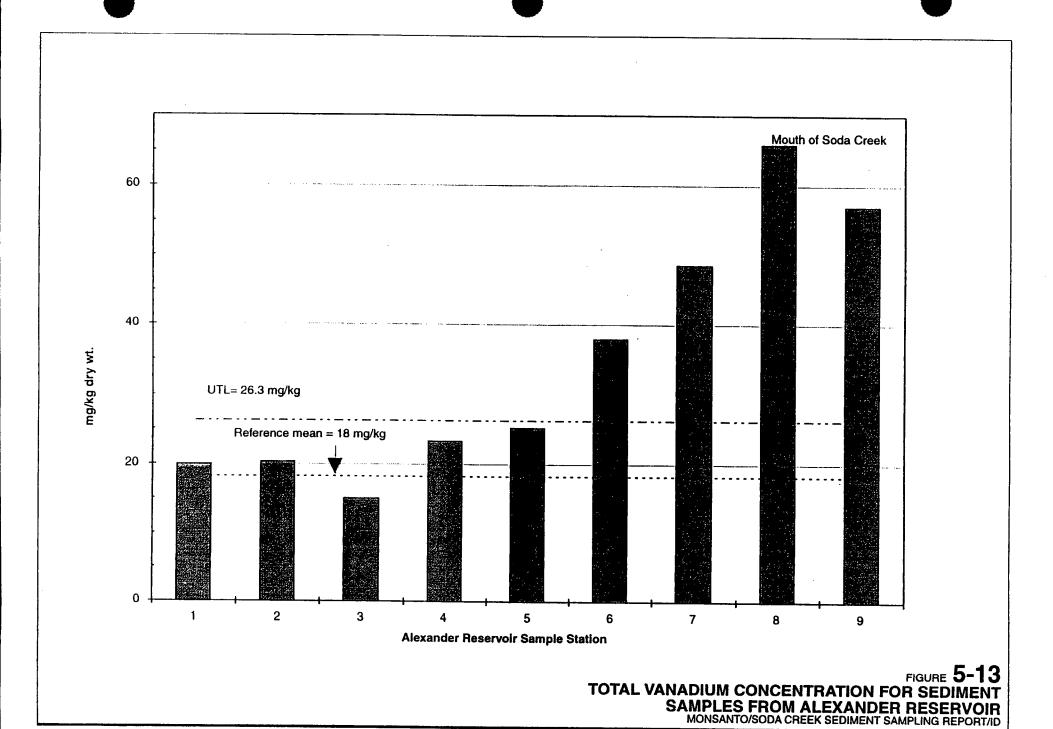




TOTAL NICKEL CONCENTRATION FOR SEDIMENT SAMPLES FROM ALEXANDER RESERVOIR MONSANTO/SODA CREEK SEDIMENT SAMPLING REPORT/ID







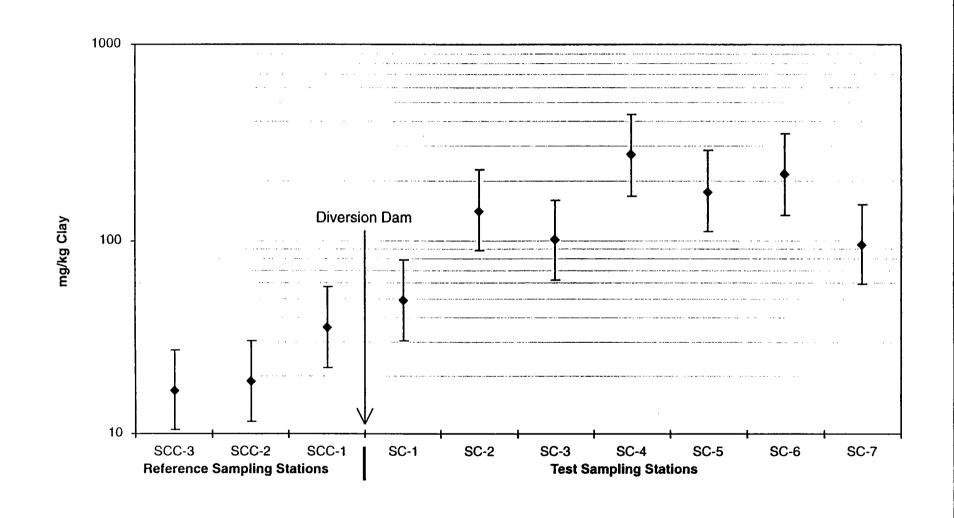


FIGURE 5-14
STANDARDIZED MEAN ARSENIC CONCENTRATIONS AND MULTIPLE
COMPARISON ERROR BARS IN SODA CREEK SEDIMENTS
MONSANTO/SODA CREEK SEDIMENT SAMPLING REPORT/ID

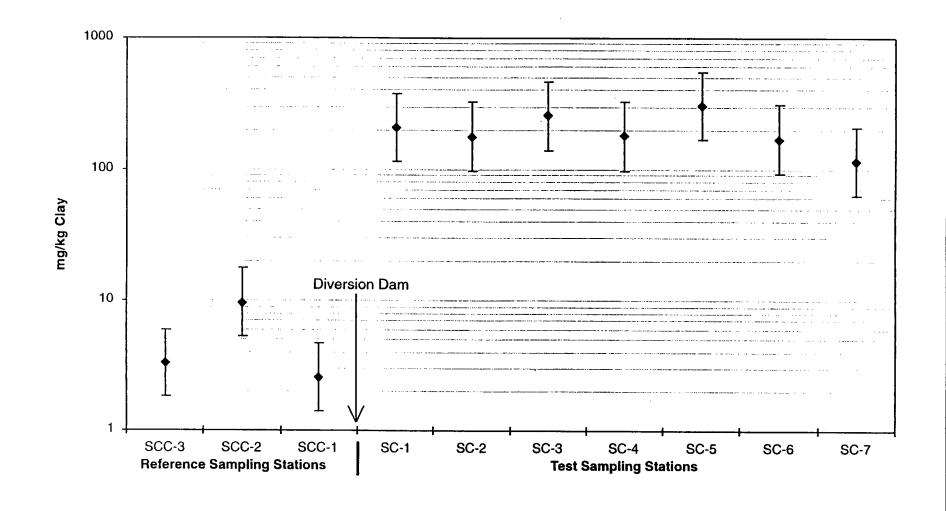


FIGURE 5-15
STANDARDIZED MEAN CADMIUM CONCENTRATIONS AND MULTIPLE
COMPARISON ERROR BARS IN SODA CREEK SEDIMENTS
MONSANTO/SODA CREEK SEDIMENT SAMPLING REPORT/ID

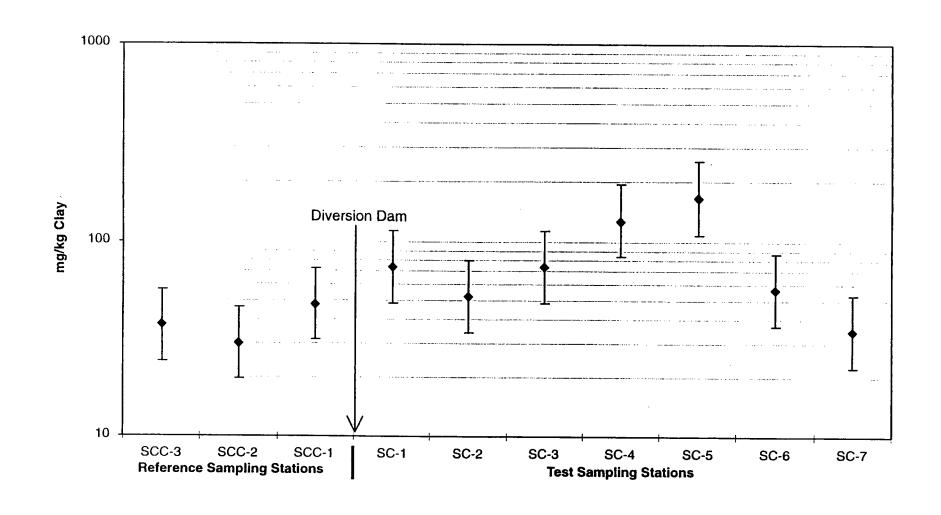
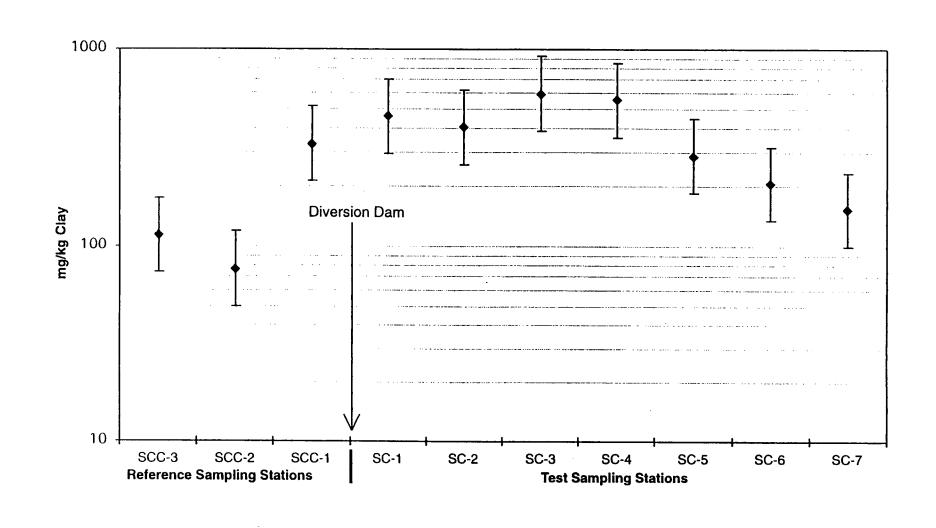
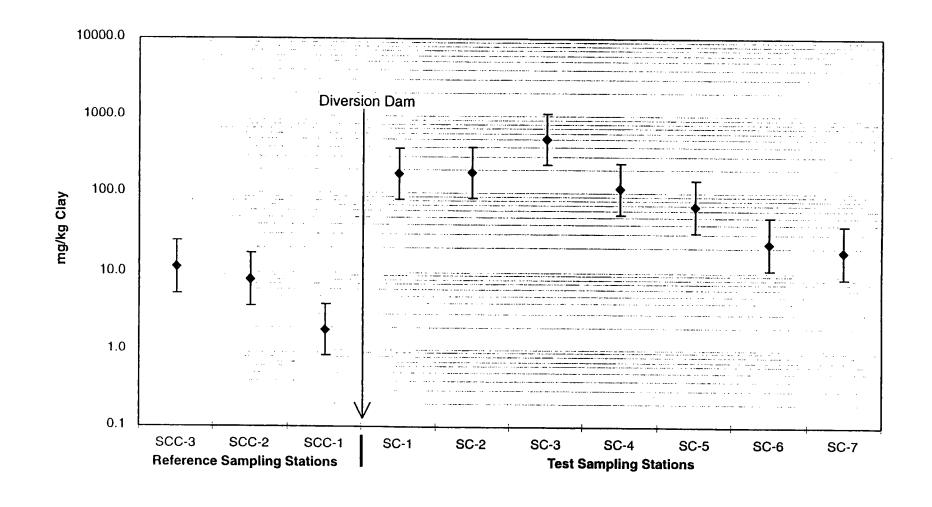


FIGURE 5-16
STANDARDIZED MEAN COPPER CONCENTRATIONS AND MULTIPLE
COMPARISON ERROR BARS IN SODA CREEK SEDIMENTS
MONSANTO/SODA CREEK SEDIMENT SAMPLING REPORT/ID



STANDARDIZED MEAN NICKEL CONCENTRATIONS AND M

COMPARISON ERROR BARS IN SODA CREEK SEDIMENTS MONSANTO/SODA CREEK SEDIMENT SAMPLING REPORT/ID



STANDARDIZED MEAN SELENIUM CONCENTRATIONS AND MULTIPLE COMPARISON ERROR BARS IN SODA CREEK SEDIMENTS MONSANTO/SODA CREEK SEDIMENT SAMPLING REPORT/ID

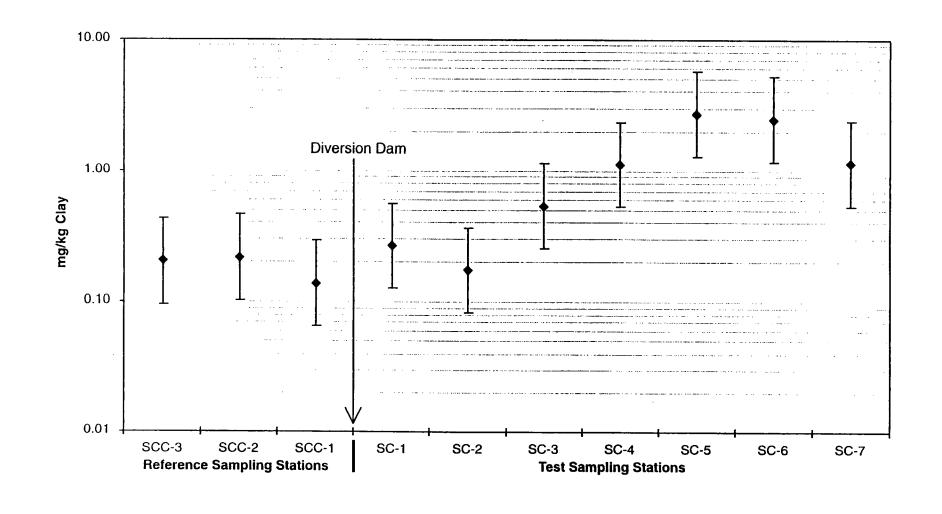


FIGURE 5-19
STANDARDIZED MEAN SILVER CONCENTRATIONS AND MULTIPLE
COMPARISON ERROR BARS IN SODA CREEK SEDIMENTS
MONSANTO/SODA CREEK SEDIMENT SAMPLING REPORT/ID

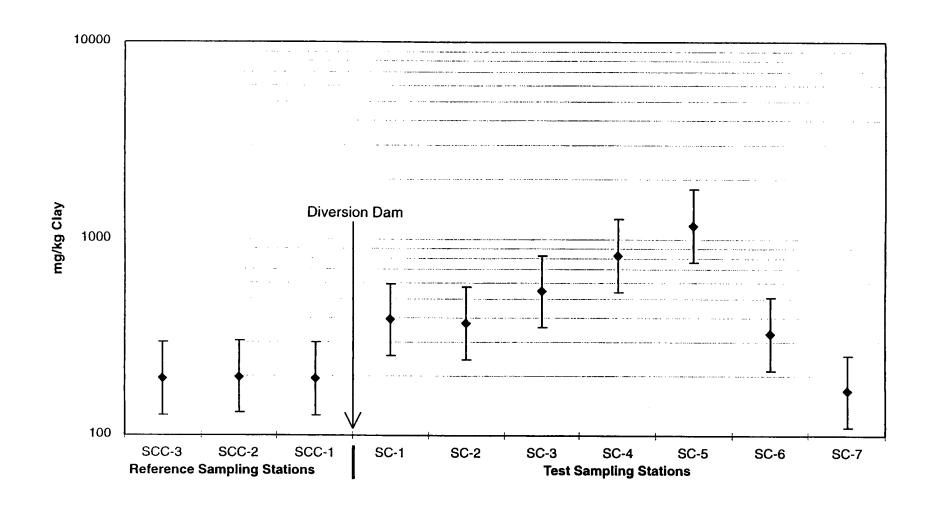
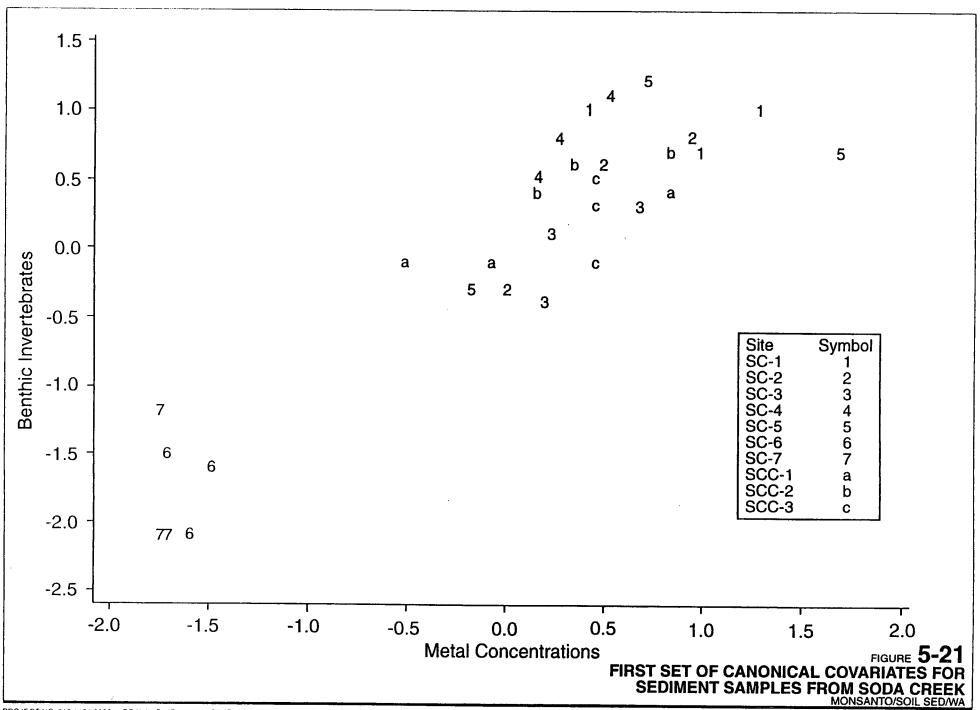
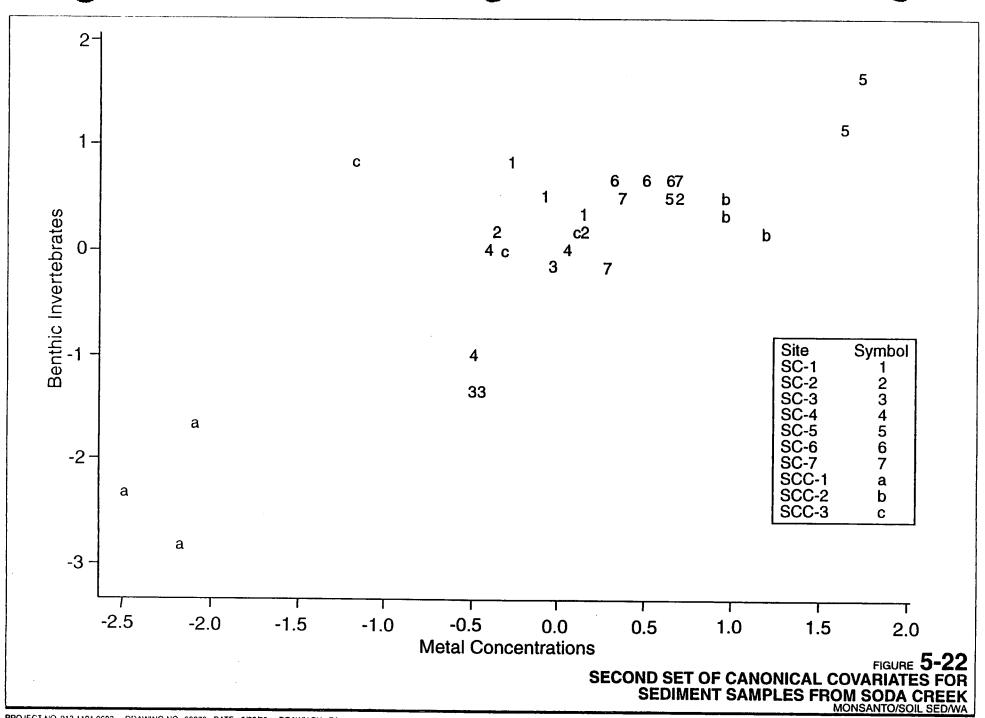


FIGURE 5-20 STANDARDIZED MEAN VANADIUM CONCENTRATIONS AND MULTIPLE COMPARISON ERROR BARS IN SODA CREEK SEDIMENTS MONSANTO/SODA CREEK SEDIMENT SAMPLING REPORT/ID





#### **TABLES**

## TABLE 3-1

# **SURFACE WATER QUALITY DATA**

SAMPLE LOCATION	EFFLUENT A	QUAL	EFFLUENT B	QUAL	EFFLUENT C	QUAL	UP NEAR	QUAL	UP MIDDLE	QUAL.	UPFAR	QUAL	DOWN A	QUAL.	DOWN B	QUAL	DOWNE	QUAL
SAMPLE DATE	(mg/L) 10/25/91		(mg/L) 10/25/91		(mg/L) 10/25/91		(mg/L) 10/25/91		(mg/L) 10/25/91		(mg/I.) 10/25/91		(mg/L) 10/25/91		(mg/L) 10/25/91		(mg/L) 10/25/91	
Aluminum	0.08	U	0.07	U	0.1		0.09		0.11		0.07	U	0.09		0.11		0.11	
Ammonium -Nitrogen	0.1	Ü	0.1	U	0.1	U	0.13	Ü	0.37	U	0.1	Ü	0.12	Ü	0.12	U	0.43	ť.
Arsenic	0.002	Ü	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	l'
Beryllium	0.001	U	0.001	U	0.001	Ü	0.001	U	0.001	U	0.001	U	0,001	U	0.001	U	0.001	ι
Cadmium	0.01		0.009		0.011		0.005	U	0.005	Ü	0.005	U	0.005	U	0.005	U	0.005	Ü
Calcium	130		138		128		84.6		79.8		77.6		88.4		83.7	1	86.2	
Chloride	159		149		153		15		15		13		29		30	<u> </u>	25	
Chromium	0.01	บ	0.01	U	0.01	บ	0.01	Ü	0.01	U	0.01	Ü	0.01	U	0.01	Ü	0.01	L!
Copper	0.007	U	0.008	U	0.008	Ü	0.005	Ŭ	0.005	υ	0.005	U	0.005	U	0.005	U	0.005	1.
Fluoride	0.43		0.42		0.4		0.31		0.31		0.31		0.31		0.34	<u> </u>	0.34	
Iron	0.051	U	0.046	U	0.04	Ü	0.93		0.47	U	0.43	U	0.54	U	0.54	T U	0.59	t:
Lab pH	8	J	8	J	8	J	6.8	1	7.1	J	7.1	J	7.1	J	7	1	7	,
Lead	0.001	UJ	0.001	UJ	0.001	UJ	0.001	UJ	0.001	UJ	0.001	UJ	0.001	UJ	0.001	U	0.002	Ü
Magnesium	61.4		65		60.3		84.1		78.4		75.5		76.5		75		78.7	
Manganese	0.005	U	0.005	Ü	0.005	U	0.083	l	0.062	<u> </u>	0.058		0.06		0.063	<u> </u>	0.063	
Nickel	0.02	U	0.02	U	0.02	Ū	0.02	U	0.02	U	0.02	Ū	0.02	Ü	0.02	U	0.02	Ü
Nitrate-Nitrogen	4.7		4.8		4.55		0.65		0.74	<u> </u>	0.73		1.16		1.14	<u> </u>	1.14	
Ortho-Phosphate	1.06		1.06		1.08		0.13	U	0.13	Ü	0.1	U	0.21	U	0.24	U	0.22	U
Potassium	7.3		7.8		7.3		10.4		9.9		9.3		9.3		9.6		10	
Selenium	.03*		.02*		.02*				<del> </del>									
Silver	0.01	U	0.01	Ü	0.01	Ŭ	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	Ţ:
Sodium	105		113		104		22		21.2		20.7		31.2		29.9		31.1	
Sulfate	%		96		96		36		30		36		42		-42		42	
Vanadium	0.12	U	0.12	U	0.21		0.01	Ŭ	0.01	U	0.01	U	0.03	U	0.03	U	0.03 -	ţ:
Zinc	0.025	U	0.037	Ü	0.031	บ	0.014	υ	0.01	U	0.009	Ü	0.012	Ü	0.015	T.	0,008	ţi
*SAMPLE DATE IS 6/9/93																		

NOTE:

See Figure 3-1 for Sample Locations Values presented are dissolved concentrations.

TABLE 3-2
WATER QUALITY OF MORMON SPRINGS

Constituent	Units	Oct-91	May-92	Nov-92	May-93	Oct-93	Apr-94	Nov-94	Mean	Standard Deviation
Aluminum	mg/L	0.05	0.965	0.0565	0.0228	0.0245	0.0949	0.01	0.046	0.0294
Ammonia (as N)	mg/L	0.05	0.025	0.015	0.015	0.015	0.015	0.023	0.023	0.0128
Arsenic	mg/L	0.002	0.002	0.001	0.0005	0.0009	0.002	0.025	0.0048	0.00894
Beryllium	mg/L	0.001 U	0.005 U	0.0008 U	NM	NM	NM	NM	< 0.005	
Cadmium	mg/L	0.018	0.01	0.0148	0.0153	0.0127	0.0161	0.0021	0.013	0.00533
Calcium	mg/L	116	121	111	NM	NM	NM	NM	116	5.00
Chloride	mg/L	113	143	120	143	178	142	130	138	21.1
Chromium	mg/L	0.01 U	0.01 U	NM	NM	NM	NM	NM	< 0.01	
Copper	mg/L	0.005 U	0.013 U	NM	NM	NM	NM	NM	< 0.013	
Fluoride	mg/L	2.2	2.96	2.2	3.6	3.6	3.78	2.9	3.0	0.660
iron	mg/L	0.0125	0.0125	0.007	0.053	0.123	0.0175	0.0025	0.033	0.0432
Lead	mg/L	0.001 U	0.005 U	NM	NM	NM	NM	NM	< 0.005	
Magnesium	mg/L	73	67	67.2	NM	NM	NM	NM	69	3.41
Manganese	mg/L	0.0025	0.0025	0.0012	0.0118	0.0123	0.0015	0.0005	0.0046	0.00513
Molybdenum	mg/L	NM	0.05	0.0514	0.0763	0.0806	0.0923	0.067	0.070	0.0168
Nickel	mg/L	0.02	0.015	0.0144	0.013	0.0108	0.0227	0.02	0.017	0.00436
Nitrate-Nitrite (as N)	mg/L	2.8	3.89	2.9	5.76	5.04	6.53	4.4	4.5	1.40
pН		7.2	7.3	7.26	7.52	7.26	7.08	7.2	7.26	0.135
Potassium	mg/L	14.6	10	10.4	NM	NM	NM	NM	12	2.55
Selenium	mg/L	0.0015	0.17	0.124	0.186	0.1676	0.168	0.14	0.14	0.0631
Silver	mg/L	0.01 U	0.0002 U	NM	NM	NM	NM	NM	< 0.01	
Sodium	mg/L	70.2	62	69.5	NM	NM	NM	NM	67	4.55
Sulfate	mg/L	114	170	159	268	267	305	190	210	70.1
Vanadium	mg/L	0.01	0.01	0.0126	0.0205	0.01765	0.0258	0.017	0.016	0.00582
Zinc	mg/L	0.151	0.195	0.133	0.208	0.22	0.266	0.175	0.19	0.0447

NOTE:

Shaded values indicate constituent not detected, value shown is one-half the detection limit.

U = Undetected NM = Not measured

# TABLE 3-3

# METAL LOADING TO SODA CREEK AT THE MONSANTO OUTFALL AND MORMON SPRINGS

Site	Arsenic		Cad	mium	Co	pper	Molyl	odenum	Ni	ckel	Sele	nium	Sil	ver	Vai	nadium
	mg/L	kg/day	mg/L	kg/day	mg/L	kg/day	mg/L	kg/day	mg/L	kg/day	mg/L	kg/day	mg/L	kg/day	mg/L	kg/day
Outfall*	NC	NC	0.01	0.110	NC	NC	NM	-	NC	NC	0.023	0.25	NC	NC	0.11	1.200
Mormon Springs**	0.0048	0.0013	0.013	0.0035	NC	NC	0.07	0.019	0.017	0.0046	0.14	0.038	NC	NC	0.016	0.0044

Assumed flow is 2020 gallons/minute Assumed flow is 50 gallons/minute Not Measured

NM

Not Calculated. Concentration less than detection level. N/C

TABLE 3-5 CONSTITUENT SUMMARY OF PHASE II SODA CREEK SEDIMENT SAMPLES

Constituent	Units	]	Reference Sedimen	Downstream Sediments			
		Mean	Standard Deviation	Maximum Detected	Maximum Detected	Number of Exceedances	
Arsenic	(mg/kg)	6.2	212	8.6	87.8	14	
Cadmium	(mg/kg)	10.8	2.55	13.4	61	15	
Copper	(mg/kg)	2.50	2.29	5	95.4	18	
Iron	(mg/kg)	3,967	4,861	9,580	1,970	0	
Molybdenum	(mg/kg)	6.5*		6.5	5	0	
Nickel	(mg/kg)	55	5.77	62	153	5	
Potassium	(mg/kg)	6,173	4,203	9,400	1,390	0	
Selenium	(mg/kg)	0.38	0.15	0.6	347	19	
Silver	(mg/kg)	<0.10	NM	< 0.1	1.8	9	
Vanadium	(mg/kg)	23	6.51	30	208	16	
Polonium-210	(pCi/g)	0.67	0.21	0.9	3.3	5	

#### Notes:

^{* =} Only one sample analyzed < = detection limit

TABLE 3-6

RESULTS OF PHASE II SODA CREEK SEDIMENT BIOLOGICAL TOXICITY TEST

Sample	Bacteria Enzyme Activity NOEC (%)	Algal Growth Reduction % of Control
Upstream		
Control A	12.5	3
Control B	25	42
Control C	25	44
Mean	21	30
Downstream		
100 A	25	5
100 B	12.5	9
100 C	6.25	2
Mean	15	5
2400 A	6.25	10
2400 B	<6.25	15
2400 C	12.5	20
Mean	7.3	15

Notes:

NOEC = No observed effects concentration

Algal growth reduction reported at sample strength of 100%.

TABLE 4-1

## SUMMARY OF TOXICITY DATA USED FROM SODA CREEK SITES FOR STATISTICAL ANALYSES

SITE	LABORATORY REPLICATE	Mortality Analysis	Growth Analysis	SITE	LABORATORY REPLICATE	Mortality Analysis	Growth Analysis
	Δ				<u></u>	<u> </u>	<b> </b>
SCC-1A	В	X	X	SC-3C	В		
	A	X	X		A	*	<del> </del>
SCC-1B	B	X	X	SC-3D	В	*	*
	С			L	C	*	*
	Α	Х	X		Λ	X	Х
SCC-1C	В	X	X	SC-4A	В		
	С	X	X		С	X	Х
000 1D	A	*	*	CC 4D	<u>A</u>		- <del></del>
SCC-1D	B ·		*	SC-4B	B C	Analysis   X	X
	T A	Х	х		A		x
SCC-2A	B	X	x	SC-4C	B		x
<i>5</i>	C	X	X		С		
	A	X	X		Α	Х	Х
SCC-2B	В	X	Х	SC-5A	В	Х	X
	С	X	Х		С	X	X
	Α	X	X		Λ		*
SCC-2C	В	X	X	SC-5B	В		•
	С	Х	X	<u> </u>	С	*	<u> </u>
	<u>A</u>	<u> </u>	X	00.50	<u>A</u>		- ;
SCC-3A	В	X	X	SC-5B	B	<u> </u>	X
	С	X	X	· · · · · · · · · · · · · · · · · · ·	+	<b>V</b>	<del></del>
SCC-3B	A B	X X	$\frac{X}{X}$	SC-5C	A B	<del></del>	X
3CC-3D	C	x	$\frac{\hat{x}}{x}$	30-30	C		x
	Ā	X	X		Ā		X
SCC-3C	В	X	х	SC-6A	В	Х	X
	С	X	х	_	С		
	Α	Х	Х		Α	X	Х
SC-1A	В	X	Х	SC-6A	В		
	С	Х	Х		С		X
	<u>A</u>	X	X		<u>A</u>	X	X
SC-1B	В	X	X	SC-6B	B C		— <del>"</del>
	С	Х	X				X
SC-1C	A B	x	X	SC-6B	A B		X
3C-1C	C	<del> ^-</del>	<del>^-</del>	30-00	c		X
	Ä	Х	x		Ā		X
SC-2A	B	×	x	SC-6C	В		X
	С	Х	Х		С		Х
<u> </u>	Α				Α	X	
SC-2B	В			SC-7A	В		
	С	X	Х		С		Х
	Α .	X	X		A	X	X
SC-2C	В	X	X	SC-7A	В		X
	С	X	X	<u> </u>	С		X
SC-3A	A B	X	X	SC-7B	A B	X Y	X
ac-an	С		<del>                                     </del>	30.78	С		X
					<u> </u>		X
SC-3B	B	X	Х	SC-7C	B	X X X X X X X X X X X X X X X X X X X	x
	C	x	X		C	X	
	<del></del>	·			Λ		Х
These sar	nples are field o in statistical an	duplicates.	and are	SC-7C	В	X	Х
Tricoc oal	die et d'et et l'est	1		1	C	X	

TABLE 5-1

PHYSICAL AND CHEMICAL CHARACTERISTICS OF SEDIMENTS FROM SODA

CREEK AND ALEXANDER RESERVOIR

Station	pН	TOC (%)	Sand (%)	Silt (%)	Clay (%)
Soda Creek ^a					
SCC-3	6.8 <u>+</u> 0.057	7.3 <u>+</u> 2.1	22 <u>+</u> 13	58 <u>+</u> 8.8	20 <u>+</u> 6.9
SCC-2	6.86 ± 0.057	5.8 <u>+</u> 0.86	10 <u>+</u> 10.0	63 <u>+</u> 7.5	27 <u>+</u> 2.5
SCC-1	7.26 ± 0.305	3.3 <u>+</u> 0.76	25 <u>+</u> 4.6	51 <u>+</u> 4.9	24 <u>+</u> 1.7
SC-1	6.8 <u>+</u> 0.0	6.1 <u>+</u> 0.98	57 <u>+</u> 3.4	33 <u>+</u> 2.1	9.8 <u>+</u> 1.5
SC-2	6.4 ± 0.057	6.0 <u>+</u> 1.5	36 <u>+</u> 7.2	48 <u>+</u> 3.8	16 <u>+</u> 3.7
SC-3	6.9 ± 0.15	9.1 <u>+</u> 0.23	13 <u>+</u> 2.5	73 <u>+</u> 6.0	15 <u>+</u> 3.7
SC-4	6.7 <u>+</u> 0.12	2.4 <u>+</u> 0.50	54 <u>+</u> 10	40 <u>+</u> 9.0	6.0 <u>+</u> 1.3
SC-5	7.0 ± 0.10	4.3 <u>+</u> 0.50	13 <u>+</u> 8.6	75 <u>+</u> 8.9	12 <u>+</u> 4.3
SC-6	6.9 ± 0.23	3.3 <u>+</u> 0.44	31 <u>+</u> 6.2	52 <u>+</u> 4.7	17 <u>+</u> 2.4
SC-7	7.3 <u>+</u> 0	4.6 <u>+</u> 0.35	25 <u>+</u> 3.3	55 <u>+</u> 3.1	20 <u>+</u> 0.26
Alexander Res	ervoir				
ARC- 1	7.4	2.9	19	56.7	24.3
ARC- 2	7.2	2.2	26.6	49.7	23.7
ARC- 3	7.6	2.3	25.5	58.5	16
ARC- 4	7.2	3.7	38.6	40.7	20.7
ARC- 5	7.4	3.3	67.3	20.1	12.6
ARC- 6	7.4	2.5	36.4	46.4	17.2
ARC- 7	7.6	3.0	13	71.9	15.1
ARC- 9	7.4	1.9	32.6	52.7	14.7
ARC- 8	7.5	2.5	84.9	8.4	6.7
ARS- 1	7.4	9.0	41.9	44.1	14
ARS- 2	7.2	1.7	47.5	40.8	11.7
ARS- 3	7.4	6.3	64.6	26.4	9
ARS- 4	7.2	2.6	46.4	42.8	10.8
ARS- 5	7.2	4.0	36.1	46.5	17.4
ARS- 6	7.0	4.8	7.5	78.1	14.4
ARS- 7	7.2	4.0	8.8	72.5	18.7
ARS- 8	7.1	4.4	12.9	70.4	16.7
ARS- 9	7.1	5.0	37.2	50.9	11.9

= Mean  $\pm$  standard deviation shown for Soda Creek Sample Stations (n=3)

TOC = Total organic carbon

Sand = 0.074 to 2 mm Silt = 0.002 to 0.074 mm

Clay =  $\leq 0.002 \text{ mm}$ 

TABLE 5-2

CONCENTRATIONS OF TOTAL METALS IN SODA CREEK SEDIMENT SAMPLES (MG/KG DRY WT.)

	Site	A	<b>A</b> g		As	(	C <b>d</b>	(	Cu	ľ	Иo		Ni	•	Se	1	V
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
	SCC-3	0.052	0.0076	3.6	0.67	0.77	0.46	7.8	1.3	<3		25	8.7	2.0	0.76	35	7.9
	SCC-2	0.075	0.026	6.2	0.40	3.2	0.26	10	1.4	<2		25	1.2	2.7	0.26	66	1.6
	SCC-1	0.042	0.024	9.2	1.6	0.72	0.33	12	0.26	1	*	85	12	0.82	1.0	50	5.5
L	SC-1	0.033	0.012	5.8	0.10	25	1.4	8.9	2.2	<4		54	1.0	21	1.2	46	4.6
L	SC-2	<0.08		30	12	38	15	11	2.6	3.3	0.58	84	33	39	16	<i>7</i> 5	10
L	SC-3	0.12	0.078	18	0	46	2.6	13	2.0	8.3	4.0	108	15	91	7.2	98	4.1
	SC-4	0.083	0.015	21	6.4	13	1.0	9.5	1.8	<2		41	3.6	8.9	2.8	61	1.4
	SC-5	0.43	0.15	28	9.0	48	15	28	12	3	*	44	4.4	11	4.4	204	108
	SC-6	0.55	0.14	49	18	37	2.4	12	1.4	<2		45	4.0	5.1	0.90	72	4.8
	SC-7	0.29	0.046	24	3.1	29	3.1	8.8	1.1	<2		39	3.6	4.7	0.58	43	4.6

Notes: N = 3

^{* -} only detected in a single sample.

TABLE 5-3

CONCENTRATIONS OF TOTAL METALS IN ALEXANDER RESERVOIR SEDIMENT SAMPLES (MG/KG DRY WT.)

Location	Ag	As	Cd	Cu	Mo	Ni	Se	V
ARC-1	0.06	2.9	0.4	9.3	<1	11	1.2	26.3
ARC-2	0.05	2.9	0.5	7.8	<0.9	10	0.7	21.8
ARC-3	0.04	2.3	0.5	7.1	<0.9	8	0.6	20.4
ARC-4	0.06	2.7	0.5	7.7	<1	9	0.6	22.6
ARC-5	0.03	2.4	<0.3	4.8	<0.8	6	0.7	14.6
ARC-6	0.05	1.9	<0.3	5.6	<0.8	7	0.5	17.9
ARC-7	0.03	2.4	<0.6	6.7	<2	8	1.3	18.5
ARC-9	0.04	1.9	0.3	5.1	<0.8	6	1.2	14.2
ARC-8	<0.02	1.7	<0.2	2.2	<0.6	3	0.4	7.5
ARS-1	0.06	5.1	8	5	<4	14	2.1	20
ARS-2	0.1	3.6	5	5.9	<0.8	13	1.4	20.3
ARS-3	0.04	5	6	4	<3	12	1.4	15
ARS-4	0.09	5.9	6.2	6.3	<1	15	2.3	23.2
ARS-5	0.08	5.6	8.9	6.4	<2	20	1.9	25.2
ARS-6	0.16	7.2	12.3	10.9	<1	20	3.2	38
ARS-7	0.24	11	21	12.4	<1	30	4	48.6
ARS-8	0.3	24	24.9	13.3	<1	35	6	65.8
ARS-9	0.25	18.2	29.5	10	<2	35	6	57

NOTES: < = Less than detection limit.



# METAL CONCENTRATIONS (MG/KG DRY WT.) IN SEDIMENT CORES COLLECTED FROM SODA CREEK AND ALEXANDER RESERVOIR.

Location	Sample Depth	Ag	As	Cd	Cu	Mo	Ni	Se	V	рН	TOC (90)
Soda Creek	<del> </del>	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	·			<del></del>	
SCC-3	0-to-2"	<0.1	3.1	2	8	<3	13	3	31	6.7	8
SCC-3	2-to-7"	0.09	6.4	<1	8	<3	56	3	52	6.8	4.3
SCC-1	0-to-2"	0.06	8.3	0.9	10.7	<0.7	63	1.6	42.2	7.3	3.7
SCC-1	2-to-8"	0.03	7.7	0.9	12.2	<0.9	95	1.2	47.4	7.3	2.5
SC-2	0-to-4"	0.1	22	63.5	16.8	4	81	63	76.4	6.7	5.8
SC-2	4-to-10"	<0.06	24	5	5.3	<2	105	15	66.7	7.1	7
SC-4	0-to-4"	0.08	24	14.6	10.8	<2	48	8.1	67.5	6.7	2.5
SC-4	4-to-10"	0.06	21	11.9	10.2	<1	34	4.9	49.1	7.1	2.5
SC-5	0-to-5"	0.46	27	43	27.6	2 .	44	11	165	7	3
SC-5	5-to-11"	0.36	15	18.3	12.9	<2	34	3.3	51.5	6.9	3.4
Alexander Reser	voir										_
ARC-3	0-to-4"	0.05	2.3	0.4	6.3	<0.8	7	0.5	20	7.7	2.7
ARC-3	4-to-8"	0.05	2.4	0.4	6.4	<0.6	8	0.4	18.6	7.8	2.6
ARC-6	0-to-4"	0.05	2.5	0.5	7.2	<0.8	8	<0.3	19.3	7.4	2.6
ARC-6	4-to-12"	0.14	2.4	2.1	9.7	<0.7	12	1.4	32	7.4	2.2
ARC-6	12-to-16"	0.14	3.4	1.9	10.5	<1	14	1.3	41.4	7.7	2.1
ARS-2	0-to-4"	0.08	4.1	5.1	6.8	<0.7	13	1.6	20.7	7.4	2.3
ARS-2	4-to-10"	0.13	4.9	4.9	8.6	<1	16	1.8	26.4	7.3	3.1
ARS-9	0-to-3"	0.21	19	26.2	8.1	<2	33	4.3	44.4	7.2	4.7
ARS-9	3-to-10"	0.33	28	18.7	8.8	<0.9	36	5.3	39.9	7.1	3.3

NOTES: < = Less than detection limit.

TABLE 5-5
SURFACE WATER CHEMISTRY

Field Location	Field pH	Temp	$O_2$	Conductivity
Alexander Reservoir		°C	(mg/L)	(µmhos/cm)
ARC-3	7.65	3.8	9.93	601
ARC-6	7.94	2.5	10.04	590
ARC-2	7.94	1.6	11.84	584
ARC-9	7.48	6.1	11.91	943
Soda Creek				
SC-6	7.36	4.8	10.41	929
SC-4	7.51	2.5	10.91	1,329
SC-3	7.48	2.3	10.38	1,386
SC-2	6.96	3.3	9.31	1,414
SCC-1	8.05	4.7	11.2	906
SCC-3	6.85	4.3	13.71	788

Laboratory	Alkalinity	Cadmium	Calcium	Conductivity	Hardness (by	Magnesium	pH (std	Selenium	Sodium	Total
Location	(mg/L	(mg/L)	(mg/L)	(umhos/cm)	Calculation)	(mg/L)	units)	(mg/L)	(mg/L)	Dissolved
	CaCO3)		1		(mg/L CaCO3)					Solids
										(mg/L)
Alexander F	eservoir						-			
ARC-3	240	<0.0002	70	670	310	32.2	7.8	0.002	25.2	380
ARC-6	240	<0.0002	70.4	650	310	32.1	8.1	0.003	35.9	370
ARS-2	250	<0.0002	73	770	340	37	7.9	0.002	25.6	350
ARS-9	510	0.0008	98.4	1100	580	82.1	7.4	0.004	26.9	640
Soda Creek	· · · · · ·	г -	<u> </u>			<del> </del>	·	1		
SC-6	490	0.0009	96	1100	570	81.1	7.1	0.003	26.2	640
SC-4	740	0.0003	119	1500	820	127	7.3	0.032	45.4	910
SC-3	740	0.0005	125	1600	870	135	7.3	0.02	48.1	950
SC-2	740	0.0003	121	1800	850	134	6.6	0.04	48.4	980
SCC-1	510	<0.0002	83.3	1100	550	83.2	7.8	<0.001	24.6	590
SCC-3	420	<0.0002	90.1	900	480	63.2	7	0.001	14.6	480

# **TABLE 5-6**

# MEAN AND STANDARD DEVIATION (MG/KG CLAY) FOR EACH OF THE CHEMICAL CONSTITUENTS AND PH IN THE SEDIMENTS AT EACH STATION IN SODA CREEK.

						Sta	tion				
	Statistic	666.0	666.0	666.1	66.1	66.2	66.3	66.1		66.4	66.
Chemical	(n=3)	SCC-3	SCC-2	SCC-1	SC-1	SC-2	SC-3	SC-4	SC-5	SC-6	SC-7
Arsenic	mean	18.3	18.8	35.9	49.1	144	103	299	189	226	95.9
	stdev	8.19	2.65	7.19	3.63	30.6	31.9	160	83.8	75.1	13.1
Cadmium	mean	3.84	9.69	2.91	208	199	266	182	326	171	115
	stdev	2.56	0.0799	1.58	16.0	99.3	91.6	39.5	161	33.5	10.8
Copper	mean	38.1	30.2	47.8	74.4	54.8	79.1	128	186	57.1	34.8
	stdev	11.2	2.42	4.68	12.4	19.9	36.4	13.9	109	10.2	4.66
Nickel	mean	131	76.9	333	458	410	601	576	298	209	154
	stdev	71.4	3.41	49.4	48.7	94.3	90.9	188	98.8	26.7	16.0
Selenium	mean	11.8	8.26	3.46	181	206	527	120	71.9	23.2	18.4
	stdev	2.53	1.57	4.54	22.2	103	181	34.5	33.0	3.02	2.11
Silver	mean	0.211	0.231	0.169	0.285	0.180	0.753	1.15	2.75	2.57	1.14
	stdev	0.0657	0.0920	0.102	0.109	0.0527	0.708	0.322	0.541	0.826	0.192
Vanadium	mean	205	200	195	389	374	565	846	1368	332	169
	stdev	76.1	19.3	2.153	16.7	21.1	198	198	946	50.6	19.9
pН	mean	6.83	6.87	7.27	6.80	6.43	6.93	6.67	7.00	6.87	7.30
_	stdev	0.058	0.058	0.3	0.00	0.058	0.153	0.115	0.10	0.231	0.00

**TABLE 5-7** 

MEAN AND STANDARD DEVIATION (MG/KG CLAY) FOR EACH OF THE CHEMICAL CONSTITUENTS AND PH FOR EACH GROUP IN THE SEDIMENT SAMPLES FROM THE RESERVOIR.

		Reference	Group 1	Group 2	Group 3
Chemical		(n=9)	(n=3)	(n=3)	(n=3)
Arsenic	mean	13.9	37.8	41.1	101
	stdev	4.41	11.6	10.7	44.2
Cadmium	mean	1.62	51.2	58.1	146
	stdev	0.664	9.95	15.3	62.9
Copper	mean	34.3	40.5	51.2	65.6
	stdev	4.25	8.46	16.9	8.06
Nickel	mean	41.7	106	118	190
	stdev	3.94	16.7	12.2	60.9
Selenium	mean	4.69	13.1	16.3	30.8
	stdev	2.07	1.38	5.58	12.8
Silver	mean	0.219	0.539	0.720	1.48
	stdev	0.0421	0.249	0.285	0.364
Vanadium	mean	101	149	187	323
	stdev	11.1	20.4	51.6	97.1
pН	mean	7.41	7.33	7.13	7.13
_	stdev	0.145	0.115	0.115	0.0577

#### Notes:

Reference consists of samples ARC-1, 2, 3, 4, 5, 6, 7, 8, and 9.

Group 1 consists of samples ARS-1, 2, and 3.

Group 2 consists of samples ARS-4, 5, and 6.

Group 3 consists of samples ARS-7, 8, and 9.

## **TABLE 5-8.**

RESULTS OF ANOVAS AND DUNNETT'S MULTIPLE COMPARISON FOR EACH OF THE CHEMICAL CONSTITUENTS AND PH FOR EACH GROUP IN THE SEDIMENT SAMPLES FROM ALEXANDER RESERVOIR.

Chemical		Resi	ults of Dunn	ett's		
	ANOVA	Multiple Comparisons†				
	p-value	Group 1	Group 2	Group 3		
Arsenic	≤0.0001	**	***	***		
Cadmium	≤0.0001	***	***	***		
Copper	0.0008	NS	*	***		
Nickel	≤0.0001	***	***	***		
Selenium	≤0.0001	**	***	***		
Silver	≤0.0001	**	***	***		
Vanadium	≤0.0001	*	**	***		
рН	0.0090	NS	*	*		

- † *** p-value ≤ 0.001
  - ** 0.001 < p-value ≤ 0.01
  - * 0.01 < p-value  $\le 0.05$

NS Not Significant, p-value > 0.05

#### Notes:

Reference consists of samples ARC-1, 2, 3, 4, 5, 6, 7, 8, and 9.

Group 1 consists of samples ARS-1, 2, and 3.

Group 2 consists of samples ARS-4, 5, and 6.

Group 3 consists of samples ARS-7, 8, and 9.

MEAN AND STANDARD DEVIATION FOR EACH OF THE BENTHIC ORGANISMS THE SEDIMENTS AT DEPOSITIONAL STATIONS IN SODA CREEK.

**TABLE 5-9** 

	Statistic	Station									
Benthic Organism	(n=3)	SCC-3	SCC-2	SCC-1	SC-1	SC-2	SC-3	SC-4	SC-5	SC-6	SC-7
Tubificidae	mean	26681	35507	92304	24478	18638	18870	41159	25261	2058	11884
	stdev	13042	14648	42587	4500	9743	5037	18453	9932	2000	7082
Tanytarsini	mean	23522	35058	0	10565	1797	145	493	16753	1739	7217
	stdev	14582	33343	0	8177	1515	251	327	13634	1959	2153
Orthocladiinae	mean	1101	449	0	768	12812	174	1058	4290	1029	594
	stdev	1053	201	0	584	10979	157	1373	3391	1377	262
Chironomini	mean	913	101	0	246	58	217	101	5000	2609	73029
•	stdev	242	176	0	289	100	376	176	4174	2269	39230
Tanypodinae	mean	275	72	116	0	0	0	478	9522	3319	478
	stdev	338	125	201	0	0	0	441	5994	4958	441
Ostracoda	mean	217	0	101	0	0	0	0	232	87	478
	stdev	376	0	176	0	0	0	0	201	76	200
Lumbriculidae	mean	0	768	101	449	870	1739	391	174	0	0
	stdev	0	887	176	370	870	2539	678	174	0	0
Helobdella stagnalis	mean	0	174	304	174	536	290	0	101	0	667
	stdev	0	157	285	301	522	283	0	176	0	500
Dina sp.	mean	0	188	696	0	652	391	101	58	14	0
	stdev	0	326	920	0	726	442	176	100	25	0
Bezzia sp.	mean	0	0	0	681	0	1130	580	174	14	0
	stdev	0	0	0	615	0	1495	756	174	25	0
Nematoda	mean	0	0	0	116	739	290	290	232	14	0
	stdev	0	0	0	100	513	283	502	402	25	0
Naididae	mean	0	0	0	0	0	0	0	0	0	7246
	stdev	0	0	0	0	0	0	0	0	0	6641
Total Invertebrates	mean	52855	72318	94319	37695	37319	24231	44942	62261	11100	102058
	stdev	19903	45747	41187	13566	20999	2865	16762	29520	12836	54408
Total Taxa	mean	5.67	5.33	4.33	7.67	7.67	7.00	6.00	10.33	8.67	8.67
	stdev	2.08	0.58	2.52	1.15	1.53	1.00	1.73	4.04	0.58	2.52

# Notes:

Shaded area indicates the mean is 5% or greater of the total number of invertebrates at the station

Values presented are organisms per square meter

MEAN AND STANDARD DEVIATION FOR EACH OF THE BENTHIC ORGANISMS IN EACH GROUP FOR THE SEDIMENT SAMPLES FROM THE RESERVOIR

**TABLE 5-10** 

			6 1		
		Control	Group 1	Group 2	Group 3
Benthic Organism	Statistic	(n=9)	(n=3)	(n=3)	(n=3)
Tubificidae	mean	3304	8333	4681	12377
	stdev	1826	8086	479	8317
Chironomus sp.	mean	1082	1160	840	565
	stdev	1049	1037	645	399
Naididae	mean	411	1464	725	898
	stdev	608	1058	411	805
Tanytarsus sp.	mean	82	174	174	855
	stdev	118	87	44	1093
Phaenopsectra sp.	mean	106	43	159	333
•	stdev	175	44	165	427
Dicrotendipes sp.	mean	29	29	0	101
	stdev	58	25	0	176
Nais (communis)	mean	43	275	72	319
·	stdev	53	266	91	329
Procladius sp.	mean	29	72	14	72
-	stdev	38	50	25	66
Podocopa sp.	mean	14	159	0	58
	stdev	22	276	0	100
Total Invertebrates	mean	5182	11853	6709	15636
	stdev	2504	11004	140	11106
Total Taxa	mean	7.89	10.67	7.00	10.33
	stdev	2.47	4.73	1.00	2.31

Shaded area indicates the mean is 5% or greater of the total number of invertebrates at the station.

Values presented are organisms per square meter.

TABLE 5-11

CANONICAL COEFFICIENTS FOR THE SEDIMENT SAMPLES FROM SODA CREEK.

	First Set of	Coefficients	
Benthic Variable	Canonical	Metal	Canonical
	Coefficient		Coefficient
Tubificidae	1.7973	Silver	-0.9441
Total Invertebrates			0.8245
Tanytarsini	anytarsini 0.4205		0.5307
Total Taxa	0.3497	Arsenic	-0.4186
Chironomini	-0.1315	Nickel	-0.3476
Orthocladiinae	0.1265	Cadmium	0.1119
Tanypodinae	-0.0291	Selenium	0.0564
	Second Set o	of Coefficients	
Benthic Variable	Canonical	Metal	Canonical
	Coefficient		Coefficient
Tanytarsini	0.6945	Cadmium	1.1772
Total Taxa	0.4189	Nickel	-1.1893
Total Invertebrates	-0.2508	Vanadium	0.8747
Orthocladiinae	0.1680	Silver	-0.3284
Chironomini			-0.2621
Tanypodinae	Tanypodinae 0.0822		-0.2122
Tubificidae	0.0678	Arsenic	-0.1029

TABLE 5-12.

BENTHIC ORGANISMS IDENTIFIED IN SEDIMENTS FROM SODA CREEK EROSIONAL STATIONS

Benthic Organism	SCC-1D	SCC-2D	SC-1D	SC-2D	SC-3D	SC-4D	SC-5D	SC-6D	SC-7D
Nematoda	0	()	()	215	215	()	11	43	0
Tubificidae	15953	3655	10535	7450	4257	989	2580	1462	3225
Naididae	0	0	0	0	0	0	0	0	1376
Helobdella stagnalis	645	387	720	0	0	86	0	Ü	0
Dina sp.	215	43	140	0	301	43	11	0	0
Hyalella azteca	1720	0	140	0	86	0	0	0	0
Gammarus lacustris	172	0	0	0	301	430	0	0	0
Baetis sp.	0	9116	0	1580	172	0	0	0	0
Psychoronia sp.	0	215	4085	0	0	537	0	0	()
Optioservus sp.	301	43	0	0	0	699	11	0	43
Orthocladiinae	43	2451	14405	15050	1376	21	129	5848	11266
Tanytarsini	43	1892	8310	1000	0	0	54	387	946
Chironomini	43	0	75	0	0	11	11	129	473
Simulium sp.	0	0	0	0	()	0	0	430	559
Physa sp.	215	0	0	0	602	118	0	0	0
Sphaerium sp.	0	0	215	0	0	11	0	0	86
Total Invertebrates	19436	17845	38840	25585	7353	3095	2807	8471	18275
Total Taxa	12	9	11	8	9	13	7	8	13

Values presented are organisms per square meter.

# **TABLE 5-13**

# MEAN AND STANDARD DEVIATION OF PERCENT MORTALITY AND ORGANISM DRY WEIGHT OF EACH STATION FOR THE SEDIMENT SAMPLES.

# Soda Creek

Parameter	Statistic	Lab Control	SCC-3	SCC-2	SCC-1
Mortality (%)	mean	17.9	7.78	8.89	18.3
	stdev	13.8	6.67	7.82	16.0
Dry Weight	mean	0.921	1.98	1.53	1.97
mg/organism	stdev	0.308	0.512	0.335	0.606

Parameter	Statistic	SC-1	SC-2	SC-3	SC-4	SC-5	SC-6	SC-7
Mortality (%)	n	7	7	5	6	7	13	15
• • •	mean	28.6	22.9	38.0	18.3	12.9	19.3	52.7
	stdev	36.3	17.0	36.3	7.53	13.8	28.4	41.1
	n	7	7	4	6	7	12	11
Dry Weight	mean	1.46	1.10	1.58	1.12	1.47	1.75	1.27
mg/organism	stdev	.673	.673	.330	.354	.412	.224	

# Alexander Reservoir

Parameter	Statistic	Lab Control	Referenc	Group 1	Group 2	Group 3
Mortality (%)	mean	17.9	9.63	4.44	6.67	8.89
	stdev	13.8	10.9	5.27	11.2	10.5
Dry Weight	mean	.921	2.34	2.04	1.48	1.28
mg/organism	stdev	.308	.343	.270	.307	.164

# **TABLE 5-14**.

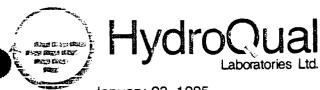
# RESULTS OF TUKEY'S MULTIPLE COMPARISON TEST FOR ORGANISM DRY WEIGHT OF THE SEDIMENT SAMPLES FROM ALEXANDER RESERVOIR.

	Res	Results of Tukey's Multiple Comparisons†										
	Reference	Reference Group 1 Group 2 Group 3										
Lab	***	***	*	NS								
Control												
Reference		NS	***	***								
Group 1	NS **											
Group 2		NS										

- † *** p-value ≤ 0.001
  - ** 0.001 < p-value  $\le 0.01$
  - * 0.01 < p-value  $\le 0.05$

NS Not Significant, p-value > 0.05

# ATTACHMENT I



January 23, 1995

FILE:94565CT.GLP

Craig Hunter Golder Associates 4104 148th Avenue N.E. Redmond Washington U.S.A. 98052

RE: 10-DAY SURVIVAL AND GROWTH

TESTS WITH CHIRONOMUS TENTANS ON

SEDIMENTS FROM SODA SPRINGS, IDAHO

Attn: Craig Hunter

The report is divided into the following sections.

- A. method overview and result summary
- B. Quality Assurance report
- C. detailed test reports
- D. sample and test information
- E. method documentation

We certify that the study was conducted according to the established study design. All deviations from protocol are documented in the Quality Assurance section.

Biologists
Stephen &

J. S. Goudey, Ph.D., P.Biol.

GENERAL MANAGER

D. Lintott, M.Sc.
LABORATORY SUPERVISOR

G. C. Balch, P.Biol.

QUALITY ASSURANCE OFFICER

landon C. Bald.



# A. METHOD OVERVIEW AND RESULTS SUMMARY

#### 1. INTRODUCTION

Ten-day static sediment screening tests with the freshwater midge, *Chironomus tentans* were conducted on whole sediments collected from Soda Springs, Idaho. The tests were performed at HydroQual Laboratories Ltd., Calgary, Alberta for Golder Associates, Redmond, Washington.

Testing was conducted according to the HydroQual Laboratories Ltd. Standard Operating Procedure, *Chironomus tentans* Sediment Toxicity Test (SOP II.IV.III.X, appended). The method was based on the standard guide for conducting sediment toxicity tests with freshwater invertebrates (American Society for Testing and Materials, 1992; appended). The test endpoints were survival and growth (weight gain).

#### 2. TEST MATERIAL

A total of 48 sediment samples were collected by Golder Associates Inc. from Soda Springs, Idaho, between November 6 to 16, 1994. The sediments were collected in Ziploc bags and shipped in four coolers. All coolers arrived with seals intact at HydroQual on November 14, 15, 16 and 18. The samples were also sealed and in good condition. The coolers were assigned sample numbers 94565-1 to 4. The sediments were assigned consecutive numbers appended to the cooler number. The sediments were stored in the shipping coolers at approximately 7°C in darkness.

#### 3. TEST SPECIES

The tests were conducted with *Chironomus tentans* larvae obtained from Aquatic Research Organisms, Hampton, NH. Tests were initiated with third instar larvae ranging

ORIGINAL

GOLDER ASSOCIATES INC., REDMOND, WASHINGTON

from 9 to 15 days of age (post-hatch). No diseases, abnormal behaviour, or excessive mortality were observed in the cultures prior to testing.

#### 4. TEST METHOD

The sediments were homogenized with the interstitial water present in the bag and dispensed to the precleaned test vessels (100 mL per 700 mL glass container). The sediments were not sieved prior to testing. Four hundred millilitres of laboratory dilution water was then added and the sediments allowed to settle overnight. The dilution water was supplemented with sodium bicarbonate to provide a better site specific assessment of toxicity (final sodium concentration of 33 mg/L).

The controls contained 100 mL of acid washed silica sand (70 mesh) and 400 mL of laboratory dilution water supplemented with sodium bicarbonate.

The testing was completed in four rounds (10 to 15 samples per round). There were three replicates for each sediment and six control replicates. The test vessels were aerated for approximately one hour before test initiation. The pH, conductance and dissolved oxygen was measured in each treatment group prior to the addition of ten chironomids. The tests were initiated on November 25, December 2, 19 and 23, 1994.

At test termination (Day 10) the sediments were sieved and the number of surviving chironomids recorded. The chironomids were then dried at 60°C and weighed to assess effects on growth. Aliquots from each set of replicates were pooled for analysis of pH, conductance, dissolved oxygen, hardness and alkalinity.

Significant differences in mortality and dry weights of the test sediments were compared to the controls by a Student's t-Test, using the computer program Toxstat (p=0.05; Gulley et al., 1991).

GOLDER ASSOCIATES INC., REDMOND, WASHINGTON

#### 5. RESULTS SUMMARY

The test results are summarized in Table 1 and the final reports are appended.

There were no deviations from the standard operating procedure for conducting sediment screening tests with *Chironomus tentans*.

#### 6. REFERENCES

Gulley, D.D., A.M. Boelter, and H.L. Bergman, 1991. Toxstat Program, Ver 3.3, Dept., Zool. Physiol., Univ. Wyoming, Laramie.

American Society for Testing and Materials. 1993. Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates. Annual Book of ASTM Standards, vol 11.04. Water and Environmental Technology. E1383-92.



GOLDER ASSOCIATES INC., REDMOND, WASHINGTON

- 4 -

TABLE 1. RESULT SUMMARY FOR SEDIMENT TESTS WITH CHIRONOMUS TENTANS

		MORTALI	TY (%)		DRY WEIGHT (mg)					
SAMPLE	SITE	AVG	SD	COMMENT	AVG	SD	COMMEN			
M94AR-001	ARC1	13	6		2.0	0.3				
M94AR-002	ARC2	7	12		2.2	0.4				
M94AR-003	ARC3	23	21		2.6	0.4				
M94AR-006	ARC4	3	6		2.2	0.1				
M94AR-007	ARC5	10	10		2.6	0.1				
M94AR-009	ARC6	7	6		2.1	0.1				
M94AR-014	ARC7	7	12		2.4	0.1				
M94AR-016	ARC8	10	10		2.5	0.3				
M94AR-015	ARC9	7	12		2.6	0.3				
M94AR-017	ARS1	3	6		2.0	0.2				
M94AR-021	ARS2	7	6		2.3	0.3				
M94AR-022	ARS3	3	6		1.9	0.3				
M94AR-023	ARS4	0	0		1.5	0.3				
M94AR-024	ARS5	13	15		1.8	0.2				
M94AR-025	ARS6	7	12		1.2	0.2				
M94AR-026	ARS7	7	12		1.4	0.0				
M94AR-027	ARSB	7	6		1.3	0.1				
M94AR-031	ARS9	13	15		1.1	0.1				
M94SC-001	SC-7A	73	46	SIG	1.5	0.0				
M94SC-002	SC-7B	10	10		1.4	0.1				
M94SC-003	SC-7C	90	10	SIG	1.4	0.1				
M94SC-005	SC-6A	40	53		1.4	0.0				
M94SC-006	SC-6B	23	40		1.2	0.3				
M94SC-007	SC-6C	13	6		1.6	0.3				
M94SC-021	SC-5A	7	6		1.5	0.1				
M94SC-022	SC-5B	33	21		0.8	0.3				
M94SC-023	SC-5B	37	29		1.0	0.1				
M94SC-024	SC-5C	20	20		1.6	0.1				
M94SC-028	SC-4A	40	35		0.8	0.3				
M94SC-029	SC-4B	37	38		8.0	0.5				
M94SC-030	SC-4C	47	47		0.9	0.9				
M94SC-033	SC-3A	20	20		1.6	0.4				
M94SC-034	SC-3B	30	26		1.5	0.3				
M94SC-035 M94SC-036	SC-3C	57	40 23		0.5	0.4 0.5				
	SC-3D	23			1.2 0.9	0.4				
M94SC-040	SC-2A	30	17 21		1.2	0.4				
M94SC-042 M94SC-044	SC-2C	17 30	36		1.5	0.7				
M94SC-045	SC-1A SC-1B	30 37	36 46		1.2	0.8				
M94SC-046	SC-1C	27	25		1.3	0.7				
				010						
M94SC-051	SCC-1A	80	26	SIG	0.6	0.3				
M94SC-052	SCC-1B	20	10		1.9	0.7				
M94SC-053	SCC-1C	10 27	0 47		2.1	0.2 0.7				
M94SC-054	SCC-1D	37 10	47 10		1.1 1.5	0.7 0.2				
M94SC-057	SCC-2A	10	10 6		1.5	0.2				
M94SC-058	SCC-2B	3	6		1.7	0.3 0.5				
M94SC-059	SCC-2C	13 7	6 6		1.7	0.5 0.7				
M94SC-065 M94SC-066	SCC-3A SCC-3B	7 10	10		1.7	0.7				
	コレレーゴロ	10	10		1.5	U.Z				

NOTES: SD, sample standard deviation; SIG, significantly different at the p=0.05 level; AVG, average of three replicates



#### B. QUALITY ASSURANCE REPORT

The Quality Assurance Unit (QAU) is responsible for ensuring that standard procedures are followed and that adequate control practices are in place for the generation of quality data. The quality of data is assessed through audits of general operating and test procedures and reviews of data collection, analyses, and reporting. The following components of the tests reported here were audited by the Quality Assurance Unit.

	TEST COMPONENT	DATE	AUDITOR
A) B) C) D)	Sample Storage and Handling Test Organisms Testing Data Analyses Reporting	4 <u>4/12/19</u> 9 <u>4/12/196</u> 29	G. BAICH G. BAICH G. BAICH G. BAICH G. BAICH

Two in-life audits were performed on the Chironomus tentans sediment tests. These audits covered test initiation and termination, and included observation of the addition and removal of test organisms, and verification of test conditions. It was found that all practices outlined in the Standard Operating Procedure for the Chironomus tentans Sediment Toxicity Test (II.IV.III.X) were followed.

G. C. Balch, P.Biol.

Signature:  $\frac{\text{Sacda C. Bald.}}{95/c1/23}$ 

Quality Assurance Officer



GOLDER ASSOCIATES INC., REDMOND, WASHINGTON

C. DETAILED TEST REPORTS



GOLDER ASSOCIATES INC., REDMOND, WASHINGTON

January 23, 1995 - 6 - 94565CT.GLP



PROJECT#: 94044-4
TEST#: 941952-1
SAMPLE#: 94565-1

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology, E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94AR-001

DATE:

94/11/06

ARC1

	INITIATION			TERMINATION						
	рН	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.2	525	7.3	8.5	605	7.5	262	172		
M94AR-001	8.3	522	7.2	8.4	620	7.3	270	216		

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	50	COMMENT
MORTALITY	0								
CONTROL	20	30	40	30	40	10	28	12	
M94AR-001	20	10	10				13	6	not toxic
Vicinity (me/s	rganiem								
CONTROL	0.8	1.7	1.0	0.6	0.7	1.1	1.0	0.4	
M94AR-001	2.2	2.1	1.6				2.0	0.3	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/11/25	AT:	1600	BY:	D. Lintott
ENDED:	94/12/05	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/09	BY:	D. Lintot	it	
VERIFIED:	95/01/19	BY:	K. Kok		X. Kek







PROJECT#: 94044-4

TEST#:

941955-1

SAMPLE#:

94565-3

# TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94SC-007

DATE:

94/11/11

SC-6C

	INITIATION			TERMINATION					
•	pН	COND	DO	pН	COND	DO	HARD	ALKAL	
CONTROL	8.3	446	8.1	8.1	548	7.9	384	228	
M94SC-007	8.4	639	8.0	8.4	651	7.5	388	268	

			REPLIC	ATE					· · · · · · · · · · · · · · · · · · ·
SAMPLE	A	В	С	D	E	F	AVG	SD.	COMMENT
MORTALITY ()	)								
CONTROL	20	40	30	20	30	30	28	8	
M94SC-007	10	10	20			<u> </u>	13	6	not toxic
WEIGHT (mg/c	rgarten								<del></del> _
CONTROL	0.7	0.5	1.1	0.6	0.5	0.6	0.7	0.2	
M94SC-007	1.3	1.9	1.7		<u> </u>		1.6	0.3	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/19	AT:	1200	BY:	D. Lintott
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintot	tt	1,
VERIFIED:	95/01/20	BY:	K. Kok		X KCK





PROJECT#: 94044-4

TEST#:

941955-2

SAMPLE#:

94565-3

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-021

DATE:

94/11/14

SC-5A

**TEST DATA:** 

	INITIAT	ION		TERMINATION						
	pН	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.3	446	8.1	8.1	548	7.9	384	228		
M94SC-021	8.6	712	8.0	8.5	724	7.4	448	288		

			REPLICA	ATE					
SAMPLE	A	В	С	D	E	F	AVG	8D	COMMENT
MORTALITY (%	5						<del></del>		<del></del>
CONTROL	20	40	30	20	30	30	28	8	
M94SC-021	10	0	10				7	6	not toxic
WEIGHT (mg/c	(ganton)						<del></del>		<b>.</b>
CONTROL	0.7	0.5	1.1	0.6	0.5	0,6	0.7	0.2	
M94SC-021	1.4	1.5	1.5			L	1.5	0.1	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/19	AT:	1200	BY:	D. Lintott
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintot	t	
VERIFIED:	95/01/20	BY:	K. Kok		K Kok





PROJECT#: 94044-4 941955-3 TEST#: 94565-3

SAMPLE#:

# TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-022

DATE:

94/11/14

SC-5B

**TEST DATA:** 

	INITIAT	ION		TERMINATION					
	pН	COND	DO	pН	COND	DO	HARD	ALKAL	
CONTROL	8.3	446	8.1	8.1	548	7.9	384	228	
M94SC-022	8.6	685	8.1	8.5	674	7.4	352	316	

			REPLIC	ATE		•			
SAMPLE	A	В	С	D	E	F	AVG	60	COMMEN
MORTALITY (9								,	
CONTROL	20	40	30	20	30	30	28	8	
M94SC-022	40	10	50				33	21	not toxic
Veloity (mak	ganien								
CONTROL	0.7	0.5	1.1	0.6	0.5	0.6	0.7	0.2	
M94SC-022	0.6	1.1	0.7				8.0	0.3	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG =average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

COMMENTS:

One large leech was observed in each of replicates A and C of the test sediment

at termination.

STARTED:	94/12/19	AT:	1200	BY:	D. Lintott
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Linto	tt	4.7
VERIFIED:	95/01/20	BY:	K. Kok		1 Kok





PROJECT#: 94044-4

TEST#:

941955-4

SAMPLE#:

94565-3

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-023

DATE:

94/11/14

SC-5B

**TEST DATA:** 

	INITIAT	TION		TERMINATION						
	рΗ	COND	DO	рН	COND	DO	HARD	ALKAL		
CONTROL	8.3	446	8.1	8.1	548	7.9	384	228		
M94SC-023	8.6	674	8.1	8.5	668	7.4	416	272		

-			REPLIC	ATE					
SAMPLE	Α	В	С	D	E	F	AVG	80	COMMENT
MORTALETY P									· · · · · · · · · · · · · · · · · · ·
CONTROL	20	40	30	20	30	30	28	8	<u> </u>
M94SC-023	20	20	70				37	29	not toxic
Visitati (majo	ganen								
CONTROL	0.7	0.5	1.1	0.6	0.5	0,6	0.7	0.2	
M94SC-023	1.0	1.1	1.0				1.0	0.1	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG =average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

**COMMENTS:** 

One large leech was observed in each of replicates A and C of the test sediment

at termination.

	044040	AT:	1200	BY:	D. Lintott
STARTED:	94/12/19	A1:	1200	D1.	D. Billon
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintot	tt	<u> </u>
VERIFIED:	95/01/20	BY:	K. Kok		KACK

ORIGHA





PROJECT#: 94044-4 TEST#: 941955-5 SAMPLE#: 94565-3

# TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-024

DATE:

94/11/14

SC-5C

**TEST DATA:** 

	INITIAT	ION		TERMINATION						
	pН	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.3	446	- 8.1	8.1	548	7.9	384	228		
M94SC-024	8.6	605	8.0	8.5	606	7.2	464	316		

			REPLIC	ATE					
SAMPLE	A	В	C	D	Ε	F	AVG	6D	COMMENT
MORTALITY (9	3							<del></del>	<u>,</u>
CONTROL	20	40	30	20	30	30	28	8	ļ
M94SC-024	0	40	20				20	20	not toxic
WEIGHT (mg/c	rganien								,
CONTROL	0.7	0.5	1.1	0.6	0.5	0.6	0.7	0.2	
M94SC-024	1.7	1.5	1.6				1.6	0.1	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/19	AT:	1200	BY:	D. Lintott
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintot	t	
VERIFIED:	95/01/20	BY:	K. Kok		K. Ksk

PROJECT#: 94044-4

TEST#:

941955-6

SAMPLE#:

94565-3

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94SC-028

DATE:

94/11/14

SC-4A

	INITIAT	NOD		TERMINATION							
	pН	COND	DO	рН	COND	DO	HARD	ALKAL			
CONTROL	8.3	446	8.1	8.1	548	7.9	384	228			
M94SC-028	8.3	517	8.3	8.2	515	7.3	516	190			

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	50	COMMENT
HOTTHESTY P	3								
CONTROL	20	40	30	20	30	30	28	8	
M94SC-028	20	80	20				40	35	not toxic
MERCHAN (BAR)	garten								
CONTROL	0.7	0.5	1.1	0.6	0.5	0.6	0.7	0.2	
M94SC-028	1.1	0.5	0.8				0.8	0.3	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

COMMENTS:

One large leech was observed in replicate B of the test sediment at termination.

STARTED:	94/12/19	AT:	1200	BY:	D. Lintott
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintot	t	1
VERIFIED:	95/01/20	BY:	K. Kok		KRAK





PROJECT#: 94044-4
TEST#: 941955-7
SAMPLE#: 94565-3

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-029

DATE:

94/11/14

SC-4B

**TEST DATA:** 

	INITIAT	ION		TERMINATION						
	pН	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.3	446	8.1	8.1	548	7.9	324	228		
M94SC-029	8.3	550	8.2	8.2	560	7.4	328	208		

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	80	COMMENT
MORTALETY P	0								
CONTROL	20	40	30	20	30	30	28	8	
M94SC-029	80	10	20				37	38	not toxic
Welgian (majo	rganiem								
CONTROL	0.7	0.5	1.1	0.6	0.5	0.6	0.7	0.2	
M94SC-029	0.2	1.1	1.0				0.8	0.5	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

**COMMENTS:** 

One large leech was observed in replicate A of the test sediment at termination.

STARTED:	94/12/19	AT:	1200	BY:	D. Lintott
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Linto	tt	
VERIFIED:	95/01/20	BY:	K. Kok		X KIL





PROJECT#: 94044-4
TEST#: 941955-8
SAMPLE#: 94565-3

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-030

SC-4C

DATE:

94/11/14

TEST DATA:

	INITIAT	TON		TERMINATION						
	pН	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.3	446	8.1	8.1	548	7.9	384	228		
M94SC-030	8.5	530	8.0	8.3	562	7.2	436	196		

			REPLICA	ATE					
SAMPLE	A	В	С	D	E	F	AVG	60	COMMENT
Herrare Res									
CONTROL	20	40	30	20	30	30	28	8	
M94SC-030	30	10	100				47	47	not toxic
veinin cer	(c)(O).)								
CONTROL	0.7	0.5	1.1	0.6	0.5	0.6	0.7	0.2	
M94SC-030	0.9	1.8	-				0.9	0.9	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

**COMMENTS:** 

One large leech was observed in replicate C of the test sediment at termination.

STARTED:	94/12/19	AT:	1200	BY:	D. Lintott
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Linto	tt	1///
VERIFIED:	95/01/20	BY:	K. Kok		K Kok







PROJECT#: 94044-4 TEST#: 941955-9

SAMPLE#: 94565-4

#### **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-033

DATE:

94/11/15

SC-3A

**TEST DATA:** 

	INITIAT	TON		TERMINATION						
	рΗ	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.3	446	8.1	8.1	548	7.9	384	228		
M94SC-033	8.6	781	8.0	8.3	671	6.2	432	528		

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	510	COMMENT
MORTAL TITE	,								
CONTROL	20	40	30	20	30	30	28	8	<u></u>
M94SC-033	20	40	0				20	20	not toxic
VEIDVO (marc	(genien)								
CONTROL	0.7	0.5	1.1	0.6	0.5	0.6	0.7	0.2	
M94SC-033	1.8	1,1	1.9				1.6	0.4	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

**COMMENTS:** 

One large leech was observed in replicate C of the test sediment at termination.

STARTED:	94/12/19	AT:	1200	BY:	D. Lintott
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Linto	tt	<u> </u>
VERIFIED:	95/01/20	BY:	K. Kok		K Kok





**PROJECT#:** 94044-4 **TEST#:** 941955-10

SAMPLE#: 94565-4

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94SC-034

SC-3B

3

DATE:

94/11/15

	INITIAT	TON		TERMINATION						
	pН	COND	DO	рΗ	COND	DO	HARD	ALKAL		
CONTROL	8.3	446	8.1	8.1	548	7.9	384	228		
M94SC-034	8.6	801	8.1	7.0	751	7.0	424	226		

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	80	COMMENT
HORRALITY V	3								
CONTROL	20	40	30	20	30	30	28	8	
M94SC-034	60	10	20				30	26	not toxic
Western and c	garakin								
CONTROL	0.7	0.5	1.1	0.6	0.5	0.6	0.7	0.2	
M94SC-034	1.1	1.8	1.6				1.5	0.3	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG =average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

**COMMENTS:** 

One large leech was observed in replicate A of the test sediment at termination.

STARTED:	94/12/19	AT:	1200	BY:	D. Lintott
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Linto	tt	
VERIFIED:	95/01/20	BY:	K. Kok		K KER





PROJECT#: 94044-4

TEST#:

941955-11

SAMPLE#:

94565-4

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-035

DATE:

94/11/15

SC-3C

**TEST DATA:** 

	INITIAT	ION		TERMINATION						
	рН	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.3	446	8.1	8.1	548	7.9	384	228		
M94SC-035	8.6	801	8.1	8.4	759	7.2	424	336		

			REPLIC	ATE				******************************	
SAMPLE	A	В	С	D	E	F	AVG	3.0	COMMENT
MORGALION G	,								
CONTROL	20	40	30	20	30	30	28	8	
M94SC-035	100	50	20				57	40	not toxic
Mesicano (neso	(630401)								
CONTROL	0.7	0.5	1.1	0.6	0.5	0.6	0.7	0.2	
M94SC-035	_	0.7	0.8				0.5	0.4	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

**COMMENTS:** 

Two leeches were observed in replicate B and one small leech in replicate C

of the test sediment at termination.

STARTED:	94/12/19	AT:	1200	BY:	D. Lintott
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintot	tt	././
VERIFIED:	95/01/20	BY:	K. Kok		1 Kok





PROJECT#: 94044-4
TEST#: 941955-12

SAMPLE#: 94565-4

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94SC-036

DATE:

94/11/15

SC-3D

	INITIAT	ION		TERMI	NATION			
	рН	COND	DO	pН	COND	DO	HARD	ALKAL
CONTROL	8.3	446	8.1	8.1	548	7.9	384	228
MOASC-036	86	780	7.8	8.4	725	7.2	452	296

			REPLIC	ATE					
SAMPLE	A	В	С	D	Ε	F	AVG	SD	COMMENT
MORTALITY (X	,								
CONTROL	20	40	30	20	30	30	28	8	
M94SC-036	10	50	10				23	23	not toxic
WESCHIT (mg/c	ganten								
CONTROL	0.7	0.5	1.1	0.6	0.5	0.6	0.7	0.2	
M94SC-036	0.7	1.7	1.1				1.2	0.5	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/19	AT:	1200	BY:	D. Lintott
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Linto	tt	
VERIFIED:	95/01/20	BY:	K. Kok		1 Kit





PROJECT#: 94044-4
TEST#: 941955-13
SAMPLE#: 94565-4

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94SC-040

DATE:

94/11/15

SC-2A

	INITIAT	ION		TERMI	NATION			
	рΗ	COND	DO	рΗ	COND	DO	HARD	ALKAL
CONTROL	8.3	446	8.1	8.1	548	7.9	384	228
M94SC-040	8.6	679	7.8	8.6	563	7.0	476	274

			REPLIC	ATE					
SAMPLE	A	В	С	D	Ę	F	AVG	- 35	COMMENT
HORTALITY (F)	6								
CONTROL	20	40	30	20	30	30	28	8	
M94SC-040	40	40	10				30	17	not toxic
WESTER'S ANGRE	(gerten								
CONTROL	0.7	0.5	1.1	0.6	0.5	0.6	0.7	0.2	
M94SC-040	1.0	0.5	1.3				0.9	0.4	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/19	AT:	1200	BY:	D. Lintott
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintot	t	1. 12
VERIFIED:	95/01/20	BY:	K. Kok		1 BAR





PROJECT#: 94044-4
TEST#: 941955-14

SAMPLE#: 94565-4

94/11/15

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

DATE:

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-041

M94SC-041

SC-2B

**TEST DATA:** 

	INITIAT	ION		TERMI	NATION			
	рΗ	COND	DO	рΗ	COND	DO	HARD	ALKAL
CONTROL	8.3	446	8.1	8.1	548	7.9	384	228

			REPLIC	ATE					
SAMPLE	A	В	С	D	Ε	F	AVG	SD	COMMENT
E(0):66)88676							·		
CONTROL	20	40	30	20	30	30	28	8	<u> </u>
M94SC-041	60	60	20				47	23	not toxic
Wasisha (mak	(10.1004)								<del>.,</del>
CONTROL	0.7	0.5	1.1	0.6	0.5	0.6	0.7	0.2	
M94SC-041	0.4	0.3	1.2		<u> </u>		0.6	0.5	not toxic

614

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

**COMMENTS:** 

One small leech was found in each of replicates A and B of the test sediment at

termination.

STARTED:	94/12/19	AT:	1200	BY:	D. Lintott
ENDED:	94/12/29	AT:	1130	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintot	tt	
VERIFIED:	95/01/20	BY:	K. Kok		K. KER



PROJECT#: 94044-4
TEST#: 941956-1

SAMPLE#:

94565-4

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94SC-042

DATE:

94/11/15

SC-2C

	INITIAT	ION		TERMINATION					
	рH	COND	DO	рН	COND	DO	HARD	ALKAL	
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228	
M94SC-042	8.4	706	7.7	8.3	656	7.4	360	308	

[			REPLICA	ATE					
SAMPLE		B	С	D	E	F	AVG	80	COMMENT
HORTALITY P	1						<del>.,</del>		<del></del>
CONTROL	0	20	0	20	10	10	10	9	<u> </u>
M94SC-042	40	10	0				17	21	not toxic
VEIGHT (HE/C	GENER								
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	ļ
M94SC-042	1.1	1,1	1.5				1.2	0,2	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALXAL=alkalinity (mg/L)

AVG = average, SD = standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintot	t	1/ //
VERIFIED:	95/01/20	BY:	K. Kok		1. Ket





PROJECT#: 94044-4
TEST#: 941956-2
SAMPLE#: 94565-4

94/11/15

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

DATE:

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-044

SC-1A

**TEST DATA:** 

	INITIATION			TERMINATION						
	pН	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228		
M94SC-044	8.1	729	7.4	8.3	695	7.5	368	292		

			REPLIC	ATE .					
SAMPLE	A	В	С	D	E	F	AVG	80	COMMENT
MORTALITY						,			
CONTROL	0	20	0	20	10	10	10	9	
M94SC-044	0	20	70				30	36	not toxic
Verringer	(egraen								<del></del>
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	
M94SC-044	2.1	1.7	0.8				1.5	0.7	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

#### **COMMENTS:**

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Linto	tt	1 11
VERIFIED:	95/01/20	BY:	K. Kok		1. Ack

ORIGHAL



PROJECT#: 94044-4
TEST#: 941956-3
SAMPLE#: 94565-4

# TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94SC-045

DATE:

94/11/15

SC-1B

	INITIAT	ION		TERMINATION					
	pН	COND	DO	рΗ	COND	DO	HARD	ALKAL	
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228	
M94SC-045	8.4	704	7.8	8.4	684	7.7	440	304	

			REPLIC	ATE					.,
SAMPLE	A	В	С	D	E	F	AVG	60	COMMEN
HORIVALITY									
CONTROL	0	20	0	20	10	10	10	9	
M94SC-045	90	10	10				37	46	not toxic
Visition (ask	3 (1) (1)						<del></del>		
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	ļ
M94SC-045	0.3	1.7	1.5				1.2	0.8	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG = average, SD = standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Linto	tt	1/ 1/
VERIFIED:	95/01/20	BY:	K. Kok		X Not





PROJECT#: 94044-4
TEST#: 941956-4
SAMPLE#: 94565-4

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

**CLIENT:** 

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-046

DATE:

94/11/15

SC-1C

**TEST DATA:** 

	INITIAT	TION		TERMINATION					
	рН	COND	DO	рH	COND	DO	HARD	ALKAL	
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228	
M94SC-046	8.2	554	8.9	8.4	477	7.5	428	284	

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	SD	COMMEN
HORTALITY ()							,		
CONTROL	0	20	0	20	10	10	10	9	ļ
M94SC-046	50	0	30				27	25	not toxic
WEIGHT (mg/	ganien								<u> </u>
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	<u> </u>
M94SC-046	0.7	2.1	1.1				1.3	0.7	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

COMMENTS:

One leech was observed at test termination in replicate A of the test sediment.

A chironomid was visible in it's digestive tract. One large leech was also

observed in replicate C.

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintot	tt	
VERIFIED:	95/01/20	BY:	K. Kok		K. Kok





PROJECT#: 94044-4 TEST#: 941956-5

SAMPLE#: 94565-4

## TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94SC-051

DATE:

94/11/16

SCC-1A

	INITIAT	ION		TERMI	NATION			
	pH	COND	DO	рΗ	COND	DO	HARD	ALKAL
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228
M94SC-051	8.3	642	9.1	8.3	668	7.3	384	248

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	80	COMMENT
MORTALITY C	3								
CONTROL	0	20	0	20	10	10	10	9	<u></u>
M94SC-051	90	50	100				80	26	significant
Westerlande	(CERTIFIE)								
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	
M94SC-051	0.4	0.8					0.6	0.3	not significant

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

**COMMENTS:** 

Two leeches were observed at test termination in replicate A of the test sediment.

One large leech was also observed in replicate C.

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Linto	tt	
VERIFIED:	95/01/20	BY:	K. Kok		1. Kok





PROJECT#: 94044-4
TEST#: 941956-6
SAMPLE#: 94565-4

94/11/16

# TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

DATE:

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-052

SCC-1B

**TEST DATA:** 

	INITIAT	ION		TERMINATION					
	pH	COND	DO	pН	COND	DO	HARD	ALKAL	
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228	
M94SC-052	8.0	702	8.8	8.3	526	7.2	504	224	

			REPLICA	ATE		•			
SAMPLE	A	В	Ü	D	E	F	AVG	8D	COMMENT
HOREAGE PAR	1								<del></del>
CONTROL	0	20	0	20	10	10	10	9	ļ
M94SC-052	10	20	30				20	10	not toxic
Vizioni rango	(Septem)								
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	<u> </u>
M94SC-052	2.1	2.5	1.1			<u> </u>	1.9	0.7	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), AL/KAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

COMMENTS:

One large leech was observed in replicate C of the test sediment at termination.

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintol	tt	7/ 7/
VERIFIED:	95/01/20	BY:	K. Kok		K KOR





PROJECT#: 94044-4

TEST#:

941956-7

SAMPLE#:

94565-4

## TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-053

DATE:

94/11/16

SCC-1C

**TEST DATA:** 

	INITIATION			TERMINATION					
	pН	COND	DO	pН	COND	DO	HARD	ALKAL	
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228	
M94SC-053	8.2	644	9.0	8.4	565	7.7	364	292	

			REPLIC	ATE	i	ı	***************************************	************	0 0000000000000000000000000000000000000
SAMPLE	A	В	C	D	E	F	AVG	60	COMMEN
HORRALTE E							<del>.,</del>		
CONTROL	0	20	0	20	10	10	10	9_	
M94SC-053	10	10	10				10	0	not toxic
MAGCATT (ANG C	conten								
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	<u> </u>
M94SC-053	2.3	1.9	2.2				2.1	0.2	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Linto	tt	
VERIFIED:	95/01/20	BY:	K. Kok		1 tel







PROJECT#: 94044-4

TEST#:

941956-8

SAMPLE#:

94565-4

# TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-054

SCC-1D

DATE:

94/11/16

**TEST DATA:** 

	INITIAT	TION		TERMINATION					
	рН	COND	DO	рН	COND	DO	HARD	ALKAL	
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228	
M94SC-054	8.3	737	9.0	8.4	697	7.6	408	232	

			REPLIC	ATE .					0 ***********
SAMPLE	A	В	С	D	E	F	AVG	SD.	COMMEN
ACRIALETY ()	3						<del></del>		,
CONTROL	0	20	0	20	10	10	10	9	
M94SC-054	20	90	0				37	47	not toxic
MERCHAT (mg/c	(gantern						·		
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	
M94SC-054	1.8	0.3	1.3				1.1	0.7	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

COMMENTS:

Two leeches were observed in replicate B of the test sediment at termination.

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintol	H	1 77
VERIFIED:	95/01/20	BY:	K. Kok		K Kick

ORGANAL



PROJECT#: 94044-4
TEST#: 941956-9

SAMPLE#: 94565-4

# TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94SC-057

DATE:

94/11/16

SCC-2A

INITIAT	ION		TERMINATION						
	COND	DO	рΗ	COND	DO	HARD	ALKAL		
	507	7.9	8.2	568	7.5	384	228		
	-	8.6	8.2	533	7.3	348	228		
	pH 8.3 8.0	8.3 507	рН COND DO 8.3 507 7.9	pH COND DO pH 8.3 507 7.9 8.2	pH         COND         DO         pH         COND           8.3         507         7.9         8.2         568	pH         COND         DO         pH         COND         DO           8.3         507         7.9         8.2         568         7.5	pH         COND         DO         pH         COND         DO         HARD           8.3         507         7.9         8.2         568         7.5         384		

			REPLIC	ATE .					
SAMPLE	A	В	С	, D	E	F	AVG	60	COMMEN
AOHEALIET P							<del></del>		<del></del>
CONTROL	0	20	0	20	10	10	10	9	<u> </u>
M94SC-057	10	0	20				10	10	not toxic
WEIGHT (mg/c	rganien								<del></del>
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	ļ
M94SC-057	1.8	1.5	1.4				1.5	0.2	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Linto	tt	1 11
VERIFIED:	95/01/20	BY:	K. Kok		1) Rick





**PROJECT#:** 94044-4 TEST#: 941956-10

SAMPLE#: 94565-4

# TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94SC-058

DATE:

94/11/16

SCC-2B

	INITIAT	ION		TERMINATION					
	рН	COND	DO	рΗ	COND	DO	HARD	ALKAL	
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228	
M94SC-058	8.1	565	8.9	8.3	523	7.5	388	292	

		-	REPLIC/	ATE .			***************************************		:
SAMPLE	À	В	С	D	E	F	AVG	60	COMMENT
HOLLTALL TO P									·
CONTROL	0	20	0	20	10	10	10	9	
M94SC-058	10	0	0				3	6	not toxic
VEIGHT (make	2001001								<del></del>
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	ļ
M94SC-058	2.0	1.7	1.3				1.7	0.3	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
STARTED.		A.T.	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	D1.	J. Cinon
REPORTED:	95/01/13	BY:	D. Lintott		1 11 11 11 11 11 11 11 11 11 11 11 11 1
		BY:	K. Kok		1 List
VERIFIED:	95/01/20	DI.	N. NOK		1 / Will





PROJECT#: 94044-4
TEST#: 941956-11
SAMPLE#: 94565-4

# TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-059

SCC-2C

DATE:

94/11/16

**TEST DATA:** 

	INITIAT	ION		TERMINATION						
	На	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228		
M94SC-059	8.0	721	8.6	8.2	742	6.5	ND	ND		

			REPLICA	ATE .					
SAMPLE	A	В	С	D	E	F	AVG	SD	COMMEN
ACREALITY P							<del>,                                    </del>		
CONTROL	0	20	0	20	10	10	10	9	ļ
M94SC-059	10	20	10				13	6	not toxic
Vizitat ri (merc	(garlea)								
CONTROL	0.8	1.1	1.0	1.0	1.2	8.0	1.0	0.1	<b></b>
M94SC-059	1.9	1.1	1.1				1.4	0.5	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at  $\rho < 0.05$ 

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel

					D 1:
STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
	95/01/13	BY:	D. Lintott		
REPORTED:		BY:	K. Kok		K Kill
VERIFIED:	95/01/20	B1:	17. 170%		110-1





PROJECT#: 94044-4 941956-12 TEST#:

94/11/16

94565-4 SAMPLE#:

# TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

DATE:

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-065

SCC-3A

**TEST DATA:** 

	INITIAT	ION		TERMINATION					
	вH	COND	DO	рΗ	COND	DO	HARD	ALKAL	
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228	
M94SC-065	8.1	567	8.5	8.3	566	6.9	300	352	

			REPLIC	ATE .				*******	
SAMPLE	A	В	С	D	E	F	AVG	SD	COMMENT
ACHTALITY (X							<del></del>		<del></del>
CONTROL	0	20	0	20	10	10	10	9	
M94SC-065	0	10	10				7	6	not toxic
VEIGHT (BUS	course en								<del></del>
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	
M94SC-065	0.9	2.0	2.3				1.7	0.7	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintott		1-1/-17-1
VERIFIED:	95/01/20	BY:	K. Kok		K KIL





PROJECT#: 94044-4
TEST#: 941956-13

SAMPLE#: 94565-4

# TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94SC-066

DATE:

94/11/16

SCC-3B

	INITIAT	ION		TERMI	NOITAN			
	На	COND	DO	pН	COND	DO	HARD	ALKAL
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228
CONTROL M94SC-066	8.3	640	9.0	8.3	536	7.2	320	248

M94SC-066 10 20 0  WEIGHT (mp/c/gambin)  CONTROL 0.8 1.1 1.0 1.0 1.2 0.8 1.0 0.1		************	*************		1	TE .	REPLICA			Γ
CONTROL 0 20 0 20 10 10 10 9 10 M94SC-086 10 20 0 1.0 1.0 10 not CONTROL 0.8 1.1 1.0 1.0 1.2 0.8 1.0 0.1		5.0	AVG	F	E	D	С	В	A	SAMPLE
CONTROL         0         20         0         20         10         10         9           M94SC-066         10         20         0         10         10         10         10         not           MSBRTS and Country           CONTROL         0.8         1.1         1.0         1.0         1.2         0.8         1.0         0.1		<del></del>	r							
M94SC-086 10 20 0 10 10 not  WEIGHT (m) regarded)  CONTROL 0.8 1.1 1.0 1.0 1.2 0.8 1.0 0.1			10	10	10	20	0	20		
WEIGHT (mg/c/ganteri)  CONTROL 0.8 1.1 1.0 1.0 1.2 0.8 1.0 0.1	ot toxic	10	10				0	20		
CONTROL 0.8 1.1 1.0 1.0 1.2 0.8 1.0 0.1			· · · · · ·						(1000)	******************
		0.1	1.0	0.8	1.2	1.0	1.0	i I		
M94SC-066 1.9 1.8 2.1 1.9 0.2 not	ot toxic	0.2	1.9							

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

	94/12/23	AT:	1100	BY:	D. Lintott
STARTED:		AT:	1100	BY:	D. Lintott
ENDED:	95/01/02				
REPORTED:	95/01/13	BY:	D. Lintott		VVI
VERIFIED:	95/01/20	BY:	K. Kok		A TAK



PROJECT#: 94044-4 941956-14

TEST#:

94565-4 SAMPLE#:

# TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

DATE:

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-067

SCC-3C

94/11/16

**TEST DATA:** 

	INITIAT	ION		TERMI	TERMINATION					
	рΗ	COND	DO	рН	COND	DO	HARD	ALKAL		
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228		
M94SC-067	8.3	717	9,2	8.4	710	7.4	272	272		

			REPLICA	ATE .		ı	***************************************		
SAMPLE	A	В	С	D	E	F	AVG	SD	COMMENT
MORTALITY ()							<del>,                                     </del>		т
CONTROL	0	20	0	20	10	10	10	9	ļ
M94SC-067	0	10	10				7	6	not toxic
WEIGHT (mg/c	rganiem								<del></del>
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	
M94SC-067	2.7	1.7	2.4				2.2	0.5	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

Γ	STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
Ļ	SIANILU.		47.	1100	BY:	D. Lintott
1	ENDED:	95/01/02	AT:	1100		<del></del>
T	REPORTED:	95/01/13	BY:	D. Lintott		<u> </u>
}		05/04/00	BY:	K. Kok		1 K Kik 1
- 1	VERIFIED:	95/01/20	1 511	111 11211		





PROJECT#: 94044-4 TEST#: 941952-2

SAMPLE#: 94565-1

## TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94AR-002

DATE:

94/11/07

ARC2

**TEST DATA:** 

	INITIAT	TON		TERMINATION						
	pН	COND	DO	рН	COND	DO	HARD	ALKAL		
CONTROL	8.2	525	7.3	8.5	605	7.5	262	172		
M94AR-002	8.3	540	7.2	8.5	627	7.7	266	222		

			REPLICA	ATE		,		**********	
SAMPLE	A	В	С	D	E	F	AVG	80	COMMENT
(0):1733-1733									
CONTROL	20	30	40	30	40	10	28	12	
M94AR-002	0	20	0				7	12	not toxic
VEJCHO (male	(aunion)								
CONTROL	8.0	1.7	1.0	0.6	0.7	1,1	1.0	0.4	
M94AR-002	2.2	2.6	1.7				2.2	0.4	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/11/25	AT:	1600	BY:	D. Lintott
ENDED:	94/12/05	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/09	BY:	D. Lintot	t	
VERIFIED:	95/01/19	BY:	K. Kok		X KOR



**PROJECT#**: 94044-4 **TEST#**: 941952-3

**SAMPLE#**: 94565-1

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94AR-003

DATE:

94/11/07

ARC3

	INITIAT	ION		TERMINATION					
	pН	COND	DO	рΗ	COND	DO	HARD	ALKAL	
CONTROL	8.2	525	7.3	8.5	605	7.5	262	172	
M94AR-003	8.3	523	7.0	8.5	630	7.2	290	250	

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	60	COMMENT
HORTISHTY (S	}								,
CONTROL	20	30	40	30	40	10	28	12	
M94AR-003	30	0	40				23	21	not toxic
A ESCENT (ENERS	(ejanten)								
CONTROL	0.8	1.7	1.0	0.6	0.7	1.1	1.0	0.4	
M94AR-003	2,8	2.2	2.9				2.6	0.4	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG =average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/11/25	AT:	1600	BY:	D. Lintott
ENDED:	94/12/05	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/09	BY:	D. Linto	tt	
VERIFIED:	95/01/19	BY:	K. Kok		K Kok





PROJECT#: 94044-4
TEST#: 941952-4
SAMPLE#: 94565-1

## TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94AR-006

DATE:

94/11/07

ARC4

	INITIAT	ION		TERMINATION					
	рН	COND	DO	pН	COND	DO	HARD	ALKAL	
CONTROL	8.2	525	7.3	8.5	605	7.5	262	172	
MOAAR-006	82	537	7.2	8.4	679	7.2	320	244	

			REPLIC	ATE		i			
SAMPLE	A	В	С	D	E	F	AVG	60	COMMEN
401114111074V									
CONTROL	20	30	40	30	40	10	28	12	
M94AR-006	0	0	10				3	6	not toxic
VEIDET GOOD	(garden)								
CONTROL	0.8	1.7	1.0	0.6	0.7	1.1	1.0	0.4	<u> </u>
M94AR-006	2.0	2.2	2.2				2.2	0.1	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/11/25	AT:	1600	BY:	D. Lintott
ENDED:	94/12/05	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/09	BY:	D. Lintot	it	1 .,/ ,/
VERIFIED:	95/01/19	BY:	K. Kok		A. KER



PROJECT#: 94044-4 TEST#: 941952-5

**SAMPLE#:** 94565-1

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94AR-007

DATE:

94/11/08

ARC5

	INITIAT	ION		TERMINATION						
	pН	COND	DO	рН	COND	DO	HARD	ALKAL		
CONTROL	8.2	525	7.3	8.5	605	7.5	262	172		
M94AR-007	8.3	528	7.3	8.5	610	7.3	266	232		

			REPLICA	ATE					
SAMPLE	A	B	С	D	E	F	AVG	SD	COMMENT
ROHYALIN (V						· · · · · · · · · · · · · · · · · · ·	<b></b>		. <del></del>
CONTROL	20	30	40	30	40	10	28	12	
M94AR-007	0	20	10				10	10	not toxic
WEIGHT (mg/c	(SERVICE)								
CONTROL	0.8	1.7	1.0	0.6	0.7	1.1	1.0	0.4	
M94AR-007	2.5	2.6	2.8				2.6	0.1	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/11/25	AT:	1600	BY:	D. Lintott
ENDED:	94/12/05	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/05	BY:	D. Linto	tt	1 ,/ ,/
VERIFIED:	95/01/19	BY:	K. Kok		1) fisk





PROJECT#: 94044-4
TEST#: 941952-6
SAMPLE#: 94565-1

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94AR-009

DATE:

94/11/08

ARC6

	INITIAT	ION		TERMINATION						
	pН	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.2	525	7.3	8.5	605	7.5	262	172		
M94AR-009	8.2	540	7.2	8.1	598	6.7	280	232		

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	80	COMMENT
10)117514(075)	1								
CONTROL	20	30	40	30	40	10	28	12	
M94AR-009	10	10	0				7	6	not toxic
MEJOHT (MAK)	(1000)								
CONTROL	0.8	1.7	1.0	0.6	0.7	1.1	1.0	0.4	
M94AR-009	2.2	2.1	1.9				2.1	0.1	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.5.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/11/25	AT:	1600	BY:	D. Lintott
ENDED:	94/12/05	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/09	BY:	D. Lintot	tt	
VERIFIED:	95/01/19	BY:	K. Kok		& KER





**PROJECT#**: 94044-4 **TEST#**: 941952-7

SAMPLE#: 94565-1

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94AR-014

DATE:

94/11/08

ARC7

**TEST DATA:** 

	INITIATION			TERMINATION						
	pН	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.2	525	7.3	8.5	605	7.5	262	172		
M94AR-014	8.3	537	7.2	8.4	706	7.3	348	268		

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	80	COMPAEN
MORTESURVE	,								<del>.,</del>
CONTROL	20	30	40	30	40	10	28	12	ļ
M94AR-014	20	0	0				7	12	not toxic
WEIGHT INGO	(SECTION)								
CONTROL	0.8	1.7	1.0	0.6	0.7	1.1	1.0	0.4	<u> </u>
M94AR-014	2.3	2.4	2.5			ļ	2.4	0.1	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.5.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/11/25	AT:	1600	BY:	D. Lintott
ENDED:	94/12/05	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/09	BY:	D. Linto	tt	
VERIFIED:	95/01/19	BY:	K. Kok		Kak



PROJECT#: 94044-4 941952-8 TEST#: 94565-1

SAMPLE#:

## TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94AR-016

DATE:

94/11/08

ARC8

	INITIAT	ION		TERMINATION					
	pН	COND	DO	рН	COND	DO	HARD	ALKAL	
CONTROL	8.2	525	7.3	8.5	605	7.5	262	172	
M94AR-016	8.2	534	7.2	8.4	606	7.3	264	232	

			REPLIC	ATE					
SAMPLE	A	В	C	D	E	F	AVG	50	COMPRENT
HORTALTTY									<del>,</del>
CONTROL	20	30	40	30	40	10	28	12	
M94AR-016	0	20	10				10	10	not toxic
Particular Grade	(SERVER)								
CONTROL	0.8	1.7	1.0	0.6	0.7	1.1	1.0	0.4	<u> </u>
M94AR-016	2.3	2.9	2.4				2.5	0.3	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.5.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test ves

STARTED:	94/11/25	AT:	1600	BY:	D. Lintott
ENDED:	94/12/05	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/09	BY:	D. Linto	tt	
VERIFIED:	95/01/19	BY:	K. Kok		KKOK





PROJECT#: 94044-4
TEST#: 941952-9

**SAMPLE#:** 94565-1

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94AR-015

DATE:

94/11/08

ARC9

	INITIAT	ION		TERMI	NATION			
	pН	COND	DO	рН	COND	DO	HARD	ALKAL
CONTROL	8.2	525	7.3	8.5	605	7.5	262	172
M94AR-015	8.3	539	7.2	8.4	711	7.1	336	248

			REPLICA	ATE					
SAMPLE	A	В	С	D	E	F	AVG	60	COMMENT
MORTALETY P									<u></u>
CONTROL	20	30	40	30	40	10	28	12	
M94AR-015	0	20	0				7	12	not toxic
NEJOHT (mg/c	gunion								
CONTROL	0.8	1.7	1.0	0.6	0.7	1.1	1.0	0.4	<u> </u>
M94AR-015	2.4	2.9	2.4				2.6	0.3	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.5.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

#### **COMMENTS:**

STARTED:	94/11/25	AT:	1600	BY:	D. Lintott
ENDED:	94/12/05	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/09	BY:	D. Linto	tt	
VERIFIED:	95/01/19	BY:	K. Kok		K Kep

ORIGHAL



PROJECT#: 94044-4 TEST#: 941954-1

**SAMPLE#:** 94565-2

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

**CLIENT:** 

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94AR-017

DATE:

94/11/09

ARS1

**TEST DATA:** 

	INITIATION			TERMINATION						
	pН	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200		
M94AR-017	8.4	521	8.1	8.5	741	7.6	350	288		

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	50	COMMEN
10010101110110	5								
CONTROL	10	0	0	0	20	0	5	8	
M94AR-017	10	0	0				3	6	not toxic
Western Gree	(aliabat)								
CONTROL	1.0	0.8	1.6	0.8	0.9	1.2	1.0	0.3	
M94AR-017	1.9	2.2	1.8				2.0	0.2	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.5.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG =average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/11	BY:	D. Lintot	tt	1-2/-/-
VERIFIED:	95/01/19	BY:	K. Kok		1 Kit







PROJECT#: 94044-4
TEST#: 941954-2

SAMPLE#: 94565-2

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94AR-021

DATE:

94/11/09

ARS2

	INITIAT	ION		TERMI	NOITAN			
	pН	COND	DO	pН	COND	DO	HARD	ALKAL
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200
M94AB-021	8.3	529	8.2	8.4	697	7.4	340	272

			REPLICA	ATE					
SAMPLE	A	В	С	D	E	F	AVG	5D	COMMEN
HORTAUTY #									<del></del>
CONTROL	10	0	0	0	20	0	5	8	
M94AR-021	0	10	10				7	6	not toxic
Western (mg/c	(carter)								<del></del>
CONTROL	1.0	0.8	1.6	0.8	0.9	1.2	1.0	0.3	
M94AR-021	2.3	2.5	2.0				2.3	0.3	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.5.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG =average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/11	BY:	D. Lintott	t	
VERIFIED:	95/01/19	BY:	K. Kok		K Kill





PROJECT#: 94044-4
TEST#: 941954-3
SAMPLE#: 94565-2

## TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94AR-022

DATE:

94/11/09

ARS3

**TEST DATA:** 

	INITIAT	TON		TERMINATION					
	pН	COND	DO	рН	COND	ĐO	HARD	ALKAL	
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200	
M94AR-022	8.4	506	8.2	8.5	628	7.4	250	260	

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	80	COMMENT
MORTALITY (%	,								
CONTROL	10	0	0	0	20	0	5	8	
M94AR-022	0	0	10				3	6	not toxic
MERCHYR (B.S.C	39,000,00								<u> </u>
CONTROL	1.0	0.8	1.6	8.0	0.9	1.2	1.0	0.3	
M94AR-022	1.7	1.8	2.2		-		1.9	0.3	not toxic

NOTE: Differences in mortality and weight between the control and tast sediment were determined by a student's I-test at p < 0.5.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/11	BY:	D. Linto	tt	
VERIFIED:	95/01/19	BY:	K. Kok		K. Kek





PROJECT#: 94044-4
TEST#: 941954-4

**SAMPLE#:** 94565-2

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94AR-023

DATE:

94/11/09

ARS4

	INITIAT	TON		TERMI	NOITAN			
	рН	COND	DO	рΗ	COND	DO	HARD	ALKAL
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200
M94AR-023	8.4	525	8.2	8.5	646	7.9	450	300

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	6.0	COMMENT
HORTALITY (1									
CONTROL	10	0	0	0	20	0	5	8	
M94AR-023	0	0	0				0	0	not toxic
Hall His Greek									
CONTROL	1.0	0.8	1.6	8.0	0.9	1.2	1.0	0.3	
M94AR-023	1.1	1.5	1.7				1.5	0.3	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.5

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/11	BY:	D. Linto	tt	<u> </u>
VERIFIED:	95/01/20	BY:	K. Kok		1. Bok



PROJECT#: 94044-4

TEST#:

941954-5

SAMPLE#:

94565-2

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94AR-024

DATE:

94/11/09

ARS5

**TEST DATA:** 

	INITIAT	ION		TERMI	NATION			
	pН	COND	DO	pН	COND	DO	HARD	ALKAL
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200
M94AR-024	8.5	523	8.2	8.5	611	7.6	440	272

			REPLIC	ATE		•		***	
SAMPLE	A	В	С	D	E	F	AVG	80	COMMEN
HORTALITY	3								
CONTROL	10	0	0	0	20	0	5	8	
M94AR-024	0	30	10				13	15	not toxic
MEIORY (majo	(Service)								
CONTROL	1.0	0.8	1.6	8.0	0.9	1.2	1.0	0.3	
M94AR-024	1,6	2.0	1.7				1.8	0.2	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.5.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/11	BY:	D. Lintot	tt	1
VERIFIED:	95/01/20	BY:	K. Kok		of Bok





PROJECT#: 94044-4
TEST#: 941954-6
SAMPLE#: 94565-2

TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94AR-025

DATE:

94/11/10

ARS6

	INITIAT	ION		TERMI				
	рН	COND	DO	pН	COND	DO	HARD	ALKAL
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200
M94AR-025	8.3	552	8.1	8.4	625	7.6	600	244

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	50	COMMENT
MORTALITY ()									
CONTROL	10	0	0	0	20	0	5	8	
M94AR-025	20	0	0				7	12	not toxic
WEIDIT (NEC	garden								_
CONTROL	1.0	8.0	1.6	0.8	0.9	1.2	1.0	0.3	
M94AR-025	1.4	1.2	1.1				1.2	0.2	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p <0.5.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/11	BY:	D. Lintot	t	
VERIFIED:	95/01/20	BY:	K. Kok		1 hop





PROJECT#: 94044-4 TEST#: 941954-7

**SAMPLE#:** 94565-2

## TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94AR-026

DATE:

94/11/10

ARS7

	INITIAT	NOF		TERMI				
	ρН	COND	DO	рΗ	COND	DO	HARD	ALKAL
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200
M94AR-026	8.4	588	8.1	8.4	656	7.7	710	236

			REPLIC	ATE					
SAMPLE	Ä	В	С	D	E	, <b>F</b>	AVG	80	COMMEN
SORYALISM.	3								
CONTROL	10	0	0	0	20	0	5	8	<u></u>
M94AR-026	20	0	0				7	12	not toxic
Details net	e e e e e e e e e e e e e e e e e e e								
CONTROL	1.0	0.8	1.6	· 0.8	0.9	1.2	1.0	0.3	
M94AR-026	1.5	1.4	1.4				1.4	0.0	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p <0.5.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/11	BY:	D. Lintot	t	
VERIFIED:	95/01/20	BY:	K. Kok		K hot





PROJECT#: 94044-4
TEST#: 941954-8
SAMPLE#: 94565-2

94/11/10

## TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

DATE:

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94AR-027

ARS8

**TEST DATA:** 

	INITIAT	ION		TERMINATION						
	pН	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200		
M94AR-027	8.4	559	8.1	8.5	591	7.7	720	240		

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	80	COMMENT
HORTALITY W									
CONTROL	10	0	0	0	20	0	5	8	
M94AR-027	10	0	10				7	6	not toxic
Vencio vanale	8-101 (CI)								
CONTROL	1.0	0.8	1.6	8.0	0.9	1.2	1.0	0.3	
M94AR-027	1.4	1.3	1.2				1.3	0.1	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p <0.5.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=aikalinity (mg/L)

AVG =average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/11	BY:	D. Lintot	tt	<u> </u>
VERIFIED:	95/01/20	BY:	K. Kok		K. Kok





PROJECT#: 94044-4
TEST#: 941954-9
SAMPLE#: 94565-2

SAMPLE

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94AR-031

DATE:

94/11/10

ARS9

**TEST DATA:** 

	INITIATION			TERMINATION					
	pН	COND	DO	pН	COND	DO	HARD	ALKAL	
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200	
M94AR-031	8.2	585	7.7	8.4	600	8.1	ND	ND	

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	39	COMMENT
HORTALETS (P									
CONTROL	10	0	0	0	20	0	5	8	
M94AR-031	10	0	30				13	15	not toxic
WEIGHT (mg/c	ganten								
CONTROL	1.0	0.8	1.6	8.0	0.9	1.2	1.0	0.3	
M94AR-031	1.1	1.0	1.2				1.1	0.1	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.5.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/11	BY:	D. Lintot	H	<u> </u>
VERIFIED:	95/01/20	BY:	K. Kok		1 Kok





PROJECT#: 94044-4 TEST#: 941954-10 SAMPLE#: 94565-3

94/11/11

## TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

DATE:

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-001

SC-7A

**TEST DATA:** 

	INITIATION			TERMINATION					
	pH	COND	DO	pН	COND	DO	HARD	ALKAL	
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200	
M94SC-001	8.2	655	7.8	8.4	689	7.7	790	208	

			REPLIC	ATE					
SAMPLE	Α	В	С	D	E	F	AVG	80	COMMENT
NORGIUT (F									
CONTROL	10	0	0	0	20	0	5	8	<u> </u>
M94SC-001	100	100	20				73	46	significant
Westernoon	rganiem								
CONTROL	1.0	0.8	1.6	0.8	0.9	1.2	1.0	0.3	
M94SC-001	•		1.5				1.5	0.0	not significant

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p <0.05.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/11	BY:	D. Linto	tt	4/
VERIFIED:	95/01/20	BY:	K. Kok		K. Kok





**PROJECT#**: 94044-4 **TEST#**: 941954-10R

**SAMPLE#:** 94565-3

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94SC-001

DATE:

94/11/11

SC-7A

	INITIAT	ION		TERMINATION					
	рН	COND	DO	рН	COND	DO	HARD	ALKAL	
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228	
M94SC-001	8.2	617	9.1	8.4	718	7.5	428	300	

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	60	COMMENT
H01151614161	3							<del> </del>	
CONTROL	. 0	20	0	20	10	10	10	9	
M94SC-001	20	90	30				47	38	significant
Arelenta Varge	(ganisa)								
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0,1	
M94SC-001	1.1	0.9	0.9				0.9	0.1	not significar

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG≔average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Linto	tt	
VERIFIED:	95/01/20	BY:	K. Kok		K.Kot



PROJECT#: 94044-4
TEST#: 941954-11

**SAMPLE#:** 94565-3

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-002

DATE:

94/11/11

SC-7B

**TEST DATA:** 

	INITIAT	ION		TERMINATION					
	pН	COND	DO	рΗ	COND	DO	HARD	ALKAL	
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200	
M94SC-002	8.1	645	7.6	8.4	719	7.9	412	252	

			REPLIC	ATE		_			
SAMPLE	A	В	С	D	E	F	AVG	50	COMMENT
MORTALETY #	0								
CONTROL	10	0	0	0	20	0	5	8	
M94SC-002	10	0	20				10	10	not toxic
Weicht ange	rgenier								
CONTROL	1.0	0.8	1.6	0.8	0.9	1.2	1.0	0.3	
M94SC-002	1.3	1.5	1.4				1.4	0.1	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p <0.05.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/11	BY:	D. Lintol	tt	<u> </u>
VERIFIED:	95/01/20	BY:	K. Kok		J. Ket





PROJECT#: 94044-4
TEST#: 941954-12
SAMPLE#: 94565-3

## **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-003

DATE:

94/11/11

SC-7C

**TEST DATA:** 

	INITIAT	ION		TERMINATION					
	pН	COND	DO	рН	COND	DO	HARD	ALKAL	
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200	
M94SC-003	8.3	626	7.9	8.5	698	7.9	430	256	

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	80	COMMENT
MORTALTO (F									
CONTROL	10	0	0	0	20	0	5	8	<u> </u>
M94SC-003	90	80	100				90	10	significant
usion org	(Cartes)								·
CONTROL	1.0	0.8	1.6	0.8	0.9	1.2	1.0	0.3	
M94SC-003	1.5	1.4					1.4	0.1	not significant

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG =average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/11	BY:	D. Linto	tt	
VERIFIED:	95/01/20	BY:	K. Kok		K. Kok





PROJECT#: 94044-4

TEST#:

941954-12R

SAMPLE#:

94565-3

## TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-003

DATE:

94/11/11

SC-7C

**TEST DATA:** 

	INITIATION			TERMINATION						
	pН	COND	DO	pН	COND	DO	HARD	ALKAL		
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228		
M94SC-003	8.2	575	9,1	8.2	652	7.4	408	272		

			REPLICA	ATE					
SAMPLE	A	В	С	D	E	F	AVG	6D	COMMENT
NORTH ENG	,								
CONTROL	0	20	0	20	10	10	10	9	
M94SC-003	20	10	100				43	49	not toxic
Visitei (r. Greic	(0.000)								
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	
M94SC-003	1.3	1.2	•				0.8	0.7	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

## **COMMENTS:**

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintot	t	<u> </u>
VERIFIED:	95/01/20	BY:	K. Kok		KKOR





PROJECT#: 94044-4
TEST#: 941954-13
SAMPLE#: 94565-3

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-005

DATE:

94/11/11

SC-6A

	INITIATION			TERMINATION					
	рН	COND	DO	pН	COND	DO	HARD	ALKAL	
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200	
M94SC-005	8.2	684	7.8	8.6	772	7.6	550	428	

1			REPLICA	ATE					
SAMPLE	A	B	С	D	E	F	AVG	80	COMMENT
BIORYALITY P							<del></del>		-p
CONTROL	10	0	0	0	20	0	5	8	
M94SC-005	20	0	100				40	53	not significant
WEIGHT (BOX	ganten								
CONTROL	1.0	0.8	1.6	0.8	0.9	1.2	1.0	0.3	
M94SC-005	1.4	1.4					1.4	0.0	not significant

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05.

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

#### **COMMENTS:**

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/11	BY:	D. Lintot	t	
VERIFIED:	95/01/20	BY:	K. Kok		X. Kik

ORIGINAL



PROJECT#:

94044-4

TEST#:

941954-13R

SAMPLE#:

94565-3

## TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates.

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

**TEST DATA:** 

M94SC-005

DATE:

94/11/11

SC-6A

	INITIATION			TERMI	NATION			
	pН	COND	DO	pН	COND	DO	HARD	ALKAL
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228
MOASC-005	82	730	9.1	8.3	745	7.2	480	320

			REPLICA	ATE					
SAMPLE	A	В	С	D	E	F	AVG	90	COMMENT
North Alexand									
CONTROL	0	20	0	20	10	10	10	9	
M94SC-005	30	60	0			_	30	30	not toxic
WEIRLY AND	(100000)								
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	
M94SC-005	2.5	1.5	2.2				2.0	0.5	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

**COMMENTS:** 

One large leech was observed in replicate B of the test sediment at termination.

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Linto	tt	
VERIFIED:	95/01/20	BY:	K. Kok		1. Kok

ORIGHAL



PROJECT#: 94044-4

TEST#: 941

941954-14

SAMPLE#:

94565-3

## TOXICITY TEST RESULTS

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

CLIENT:

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-006

DATE:

94/11/11

SC-6B

**TEST DATA:** 

	INITIATION			TERMINATION					
	pH	COND	DO	рН	COND	DO	HARD	ALKAL	
CONTROL	8.5	464	8.2	8.2	530	6.4	178	200	
M94SC-006	8.2	605	8.2	8.6	771	7.6	590	340	

			REPLIC	ATE					
SAMPLE	A	В	С	Q	E	F	AVG	60	COMMENT
MOREFALETY (F)	1							·	
CONTROL	10	0	0	0	20	0	5	8	
M94SC-006	0	70	0				23	40	not toxic
Wearing and	91000								
CONTROL	1.0	0.8	1.6	0.8	0.9	1.2	1.0	0.3	
M94SC-006	1.4	0.9	1.4				1.2	0.3	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (u8/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

COMMENTS:

One leech was observed in replicate B of the test sediment at test termination.

STARTED:	94/12/02	AT:	1200	BY:	D. Lintott
ENDED:	94/12/12	AT:	1000	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintot	nt	ļ
VERIFIED:	95/01/20	BY:	K. Kok		L. Kek





PROJECT#: 94044-4

941954-14R TEST#:

94565-3 SAMPLE#:

94/11/11

# **TOXICITY TEST RESULTS**

PROTOCOL:

Chironomus tentans 10 Day Static Acute Lethality Test

screening test (single concentration)

REFERENCE:

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates

DATE:

1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental

Technology. E1383-93.

**CLIENT:** 

GOLDER ASSOCIATES, Redmond, Washington

SAMPLE:

M94SC-006

SC-6B

**TEST DATA:** 

	INITIATION			TERMINATION				
	pH	COND	DO	pН	COND	DO	HARD	ALKAL
CONTROL	8.3	507	7.9	8.2	568	7.5	384	228
M94SC-006	8.3	646	9.4	8.4	755	7.4	308	324

			REPLIC	ATE					
SAMPLE	A	В	С	D	E	F	AVG	60	COMMENT
EORFEETBAR									<del>,</del>
CONTROL	0	20	0	20	10	10	10	9	
M94SC-006	0	10	10				7	6	not toxic
Western (mare	(canter)								
CONTROL	0.8	1.1	1.0	1.0	1.2	0.8	1.0	0.1	
M94SC-006	1.5	2.1	2.2				1.9	0.4	not toxic

NOTE: Differences in mortality and weight between the control and test sediment were determined by a student's t-test at p < 0.05

COND=conductivity (uS/cm), DO=dissolved oxygen (mg/L), HARD=hardness (mg/L), ALKAL=alkalinity (mg/L)

AVG=average, SD=standard deviation

The test was initiated with 10 chironomids per test vessel.

## **COMMENTS:**

STARTED:	94/12/23	AT:	1100	BY:	D. Lintott
ENDED:	95/01/02	AT:	1100	BY:	D. Lintott
REPORTED:	95/01/13	BY:	D. Lintol	tt	
VERIFIED:	95/01/20	BY:	K. Kok		Kok'



D. SAMPLE AND TEST INFORMATION



GOLDER ASSOCIATES INC., REDMOND, WASHINGTON

January 23, 1995 - 7 - 94565CT.GLP

**SAMPLE#**: 94565-1

CLIENT#:

94044-4

# SAMPLE AND TEST INFORMATION

CHENT INFO	CLIENT INFORMATION		CLIENT:	Golder Associates	Inc.	
			OPERATION	•		
STREET:	4104 - 148th A	venue N.E.	CONTACT:	David Banton		······································
CITY:	Redmond		TEL:	206-883-0777	FAX:	206-882-5498
PROV/STATE:	Washington		SUBLET:	not applicable	<del></del>	
COUNTRY/PC:	U.S.A.	98052	BILLING:	Project#: 913-110	1.603	

# SAMPLE INFORMATION

SAMPLE:	sediment; Monsanto/Soda S	prings, ID		TYPE:	grab
COMMENTS:	M94AR-001; 002; 003; 006; 0	007; 009; 014	; 016; 015		<u> </u>
COLLECTED BY:	Craig Hunter	DATE:	94/11/06-08	TIME:	0845-1430

# SAMPLE SHIPMENT

CONTAINER:	9*large ziploc bags	COMMENT:	air waybill#: 4	400-9722-0701
CARRIER:	Federal Express	DATE:	94/11/09	

# TESTING FACILITY

LOCATION:	HydroQual Laboratories	Ltd., 3-6125 12th St. S.E., Calgan	y, AB T2H 2K1
CONTACT:	S. Goudey	TEL: (403) 253-7121	FAX: (403) 252-9363
RECEIVED BY:	K. Kok	DATE: 94/11/14	TIME: unknown
SEALED:	yes	COMMENT: official Golder	
COLOUR:	not available	ODOUR: not available	
COMMENTS:	official Golder Ass. seal	was broken by Agriculture Canada	to inspect the sediment

	MEREN		•		
COND(uS/cm):	not done	DO (mg/L):	not done	HARDNESS (mg/L CaCO3):	not done
pH:	not done	T (oC):	not done	NH4+(mg/L):	not done
TRC(mg/L):	not done				

# SAMPLEHISTORY

STORAGE:	5oC in the dark				
DISPOSAL:	not available	DATE:	not available	BY:	not available
COMMENTS:	no comments		<u>-</u>		Lvanasio



**SAMPLE#:** 94565-2

CLIENT#: 94044-4

# SAMPLE AND TEST INFORMATION

CUENT INFO	CLIENT INFORMATION			Golder Associates	Inc.	
			OPERATION			
STREET:	4104 - 148th A	venue N.E.	CONTACT:	David Banton		
CITY:	Redmond		TEL:	206-883-0777	FAX:	206-882-5498
PROV/STATE:	Washington		SUBLET:	not applicable		
COUNTRY/PC:	U.S.A.	98052	BILLING:	Project#: 913-110	1.603	

# SAMPLE INFORMATION

SAMPLE:	sediment; Monsanto/Soda S	prings, ID		TYPE:	grab
COMMENTS:	M94AR-017; 021; 022; 023; 0	024; 025; 026	6; 027; 031		
COLLECTED BY:	Craig Hunter	DATE:	94/11/09-10	TIME:	0845-1605

# SAMPLE SHIPMENT

CONTAINER:	9*large ziploc bags	COMMENT:	air waybill#: 400	-9722-0686
CARRIER:	Federal Express	DATE:	94/11/14	

# TESTING PAGETY

LOCATION:	HydroQual Laborato	ries Ltd., 3-6125 12th St. S.E., Calga	ary, AB T2H 2K1
CONTACT:	S. Goudey	TEL: (403) 253-7121	FAX: (403) 252-9363
RECEIVED BY:	K. Poirrier	DATE: 94/11/15	TIME: unknown
SEALED:	yes	COMMENT: official Gold	er Ass. seal #9396
COLOUR:	not available	ODOUR: not available	9
COMMENTS:	official Golder Ass. se	eal was intact upon arrival	

# 

COND(uS/cm):	not done	DO (mg/L):	not done	HARDNESS (mg/L CaCO3):	not done
pH:	not done	T (oC):	not done	NH4+(mg/L):	not done
TPC/ma/L\·	not done				

# SAMPLE HEATORY

STORAGE:	5oC in the dark				
DISPOSAL:	not available	DATE:	not available	BY:	not available
COMMENTS:	no comments				



**SAMPLE#**: 94565-3

CLIENT#:

94044-4

# SAMPLE AND TEST INFORMATION

CLIENT INFO	RMATION		CLIENT:	Golder Associates	Inc.	
			OPERATION	•		
STREET:	4104 - 148th A	venue N.E.	CONTACT:	David Banton	·····	
CITY:	Redmond		TEL:	206-883-0777	FAX:	206-882-5498
PROV/STATE:	Washington		SUBLET:	not applicable		
COUNTRY/PC:	U.S.A.	98052	BILLING:	Project#: 913-110	1.603	

# SAMPLE INFORMATION

SAMPLE:	sediment; Monsanto/Soda Sp	orings, ID		TYPE:	grab
COMMENTS:	M94SC-001; 002; 003; 005; 0	006; 007; 021	; 022; 023; 024; 028	; 029; 030	
COLLECTED BY:	Craig Hunter	DATE:	94/11/11&14	TIME:	1005-1545

# SAMPLE SHIPMENT

CONTAINER:	13*large ziploc bags	COMMENT	air waybill#: 400	-9722-0675
CARRIER:	Federal Express	DATE:	94/11/15	

# TESTING FACILITY

LOCATION:	HydroQual Laboratories L	td., 3-6125 12th St. S.E., Calgar	y, AB T2H 2K1
CONTACT:	S. Goudey	TEL: (403) 253-7121	FAX: (403) 252-9363
RECEIVED BY:	K. Kok	DATE: 94/11/16	TIME: unknown
SEALED:	yes	COMMENT: official Golder	Ass. seal #9096
COLOUR:	not available	ODOUR: not available	
COMMENTS:	official Golder Ass. seal wa	as intact upon arrival	

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ă	3	ŝ	я		2	8	٤	ŝ	Я	ľ	ı	Ž		3		۲	ı		ũ	ı	ş	3	ì	ĭ	ŝ	Ř	ä	١	۲	ı	ı	٤	Ė	۹	X	ı	ŀ	ř	t	1	k	ł	ij	Š	3	E	٤		ř	i	ı	S	ı	ø	8	á
q	ч	и	х	×	R	3	b	ь	٠	в	Ç	ø	a	Ü	×	۲	2	٤	9	٠	k	9	ö	١	ı	ı	٠	7	2	8	S	٤	d	X	λ	з	u	ι	ŀ	S	ò	ě	ı	a	ī.	ĕ	8	8	В	ĸ.	2	х	ı	ä	8	á

COND(uS/cm):	not done	DO (mg/L):	not done	HARDNESS (mg/L CaCO3):	not done
pH:	not done	T (oC):	not done	NH4+(mg/L):	not done
TRC(mg/L):	not done				

# SAMPLE HISTORY

STORAGE:	5oC in the dark				
DISPOSAL:	not available	DATE:	not available	BY:	not available
COMMENTS:	no comments			· · · · · · · · · · · · · · · · · · ·	



SAMPLE#: 94565-4 CLIENT#: 94044-4

# SAMPLE AND TEST INFORMATION

CLIENTINEC	FMATION		CLIENT:	Golder Associates	Inc.	
			OPERATION	•		
STREET:	4104 - 148th A	venue N.E.	CONTACT:	David Banton		
CITY:	Redmond	-	TEL:	206-883-0777	FAX:	206-882-5498
PROV/STATE:	Washington		SUBLET:	not applicable		
COUNTRY/PC:	U.S.A.	98052	BILLING:	Project#: 913-110	1.603	

# SAMPLE INFORMATION

SAMPLE:	sediment; Monsanto/Soda Springs, ID			TYPE:	grab
COMMENTS:	M94SC-033to036; 040to042; 044; 045; 046; 051to054; 057; 058; 059; 065; 066; 067				
COLLECTED BY:	Craig Hunter	DATE:	94/11/15&16	TIME:	0845-1610

# SAMPLE SHIPMENT

CONTAINER:	20*large ziploc bags	COMMENT:	air waybill#: 400	-9722-0664
CARRIER:	Federal Express	DATE:	94/11/17	

# STEELSH NIGHEALONE TRY

LOCATION:	HydroQual Laboratories Ltd., 3-6125 12th St. S.E., Calgary, AB T2H 2K1					
CONTACT:	S. Goudey	TEL: (403) 253-7121 FAX: (403) 252-9363				
RECEIVED BY:	K. Kok	<b>DATE:</b> 94/11/	/18	TIME:	unknown	
SEALED:	yes	COMMENT: official	l Golder As	s. seal #9097		
COLOUR:	not available	ODOUR: not av	/ailable			
COMMENTS:	official Golder Ass. seal was intact upon arrival					

# NITE AND STRUCTURE OF THE STREET

COND(uS/cm):	not done	DO (mg/L):	not done	HARDNESS (mg/L CaCO3):	not done
pH:	not done	T (oC):	not done	NH4+(mg/L):	not done
TRC(ma/L):	not done				

# SAMPLE HISTORY

STORAGE:	5oC in the dark				
DISPOSAL:	not available	DATE:	not available	BY:	not available
COMMENTS:	no comments				



## E. METHOD DOCUMENTATION

- 1. HydroQual Laboratories Ltd. Standard Operating Procedure for Conducting the Chironomus tentans Sediment Toxicity Test
- 2. American Society of Testing and Materials, Guideline E1383-92



GOLDER ASSOCIATES INC., REDMOND, WASHINGTON

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## II.IV.III.X. CHIRONOMUS tentans STATIC ACUTE SEDIMENT TEST

#### 1. INTRODUCTION

The method outlined below is the standard operating procedure for conducting a 10-day static sediment toxicity test using the midge, *Chironomus tentans*.

#### TEST ORGANISMS

#### 2.1 TEST SPECIES

Chironomus tentans (Diptera) are widely-distributed non-biting flies (midges), which have four life stages: egg, larva, pupa, and adult. Midge larvae are found in the top few centimetres of sediment, and feed on the sediment surface.

Tests are started with larvae which should be 9 to 13 days after hatch (third instar), and are no older than 16 days. Midges can be obtained from a commercial supplier, either as testing age larvae, or as egg cases.

SUPPLIER: A

Aquatic Research Organisms (ARO)

P.O. Box 1271

One Lafayette Road Hampton, NH 03842 phone: (603) 926-1650 fax: (603) 926-5278

Midges can also be obtained from in-house cultures. Twelve to 16 days before testing, at least 3 freshly laid midge egg cases are placed in a clean glass pan filled with water to a depth of 3 cm. Three egg cases will give approximately 200 to 300 juveniles.

The egg cases are isolated by aspirating adults into the aspirating jar in the morning. In the late afternoon, about 300 mL of tap water is added to the flask. Egg cases are deposited overnight and first instar larvae begin to hatch after about 2 to 3 days at 20°C. Egg cases must be checked using a stereo-microscope each morning for the start of hatching, which is to be recorded in the Chironomid Culture Log Book, along with the lot number of eggs (lot number = CTEYYMMDD).

Once hatching begins, Nutrafin dissolved in deionized water is added once daily to the culture at a rate of 5 mL of a 1 g/100 mL stock. The stock food solution can be made ahead and stored in the fridge for two weeks. Deionized water is added as needed to make up for evaporation. The larvae in the rearing pans are presumed to be third instar on the 12th day from the time the eggs were laid (9 day old larvae). Most larvae will remain as third instars through the 16th day (13 day old larvae).

Larvae older than sixteen days should not be used to start a test.

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## 2.2 Dilution Water

Dechlorinated tap water is used as culture water and as dilution water. This water is referred to as laboratory dilution water.

#### 3. TEST FACILITY

The tests are conducted in the  $20\pm2^{\circ}$ C test area. Test temperatures are recorded daily from thermometers placed in the test area.

#### 3.1 Test Vessel

Tests are conducted in glass jars. The volume of the jar depends on the amount of test sediment available, but is usually a 700 mL glass jar, with a sediment to dilution water ratio of 1:4. Each 700 mL jar contains 100 mL of whole sediment and 400 mL of dilution water. The remainder of the SOP refers to testing using the 700 mL glass jar.

#### 4. GENERAL TEST PROCEDURE

All information about the test is recorded on the bench sheet. The bench sheet is kept in the test area throughout the test. Feeding and other comments regarding testing should be recorded on the Project Sheet.

## 4.1 Sample Handling

- tests should be initiated within fourteen days of sample collection, and must be initiated within six weeks of sample collection
- the sample is stored in the cold room if the test is not initiated within 24 h

Field-collected sediments should normally not be prepared for testing by sieving, as this would remove contaminants present in the pore water or loosely adsorbed to particulates. Large debris or large indigenous organisms should be removed using forceps. To achieve a homogeneous sample, either mix it in the transfer/storage container, or transfer it to a clean bowl and stir by hand using a plastic spoon or spatula, until its texture and colour are homogeneous. Any liquid which has separated from the sample during its transport and storage must be re-mixed within the sample. Immediately following sample mixing, subsamples of the test substance are collected for testing and transferred to labelled containers.

## 4.2 Test Design

For screening tests, transfer 100 mL of homogenized test sediment to each of a minimum of three test jars. A minimum of three control sediments should be tested with the screens, which consists of acid washed 70-mesh silica sand. If several screening tests are being conducted on the same day, one set of controls can be run using a minimum

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of 6 replicates. The number of replicates should be increased with the number of tests. To each test and control sediment, gently add 400 mL of dilution water to the sediments. The dilution water should be poured along the sides of the jar, or along a glass pipette, so as to minimize sediment disturbance.

The definitive test is conducted using five or more test concentrations of wet sediment, diluted with control sediment. Test concentrations for unknown sediments are 6.25%, 12.5%, 25%, 50% and 100%, Control sediment can be either a natural or artificially prepared clean sediment. The artificial sediment used is either silica sand which has been soaked in 5% sulfuric acid and rinsed in deionized water until pH is neutral, or an artificial sediment prepared from recipes provided in the attached references. The choice of artificial sediment will depend on the client's requirements. A natural reference sediment is one which has been collected from an area known to have similar sediment characteristics and no toxicity. Since a natural sediment used for dilution is an experimental sediment, a natural sediment control and a laboratory sediment control (silica sand) will be tested concurrently.

## 4.3 Preparation of Sediment Dilutions

Test sediment dilutions are prepared by adding the required amount of dilution sediment to test sediment. The addition of dilution sediment is done on a volume basis. The percent moisture content of the test and dilution sediment is not corrected for. The total volume of diluted sediment is 300 mL per treatment level. A minimum of 600 mL of test sediment is required for each test. The sediment dilutions are mixed by hand to homogenize, then distributed to three replicate test vessels (100 mL of sediment to each). After distribution of test material to test vessels, 400 mL of dilution water is added gently to the test vessel so as to minimize sediment disturbance. The test vessels are allowed to settle overnight, at a minimum.

The test vessels are aerated for at least one hour prior to test initiation, using a one-mL disposable pipette attached to an air line which is placed in the test vessel 2 cm from the sediment. Aeration is provided at a rate low enough to prevent resuspension of sediment.

## 4.4 Test Initiation

Just prior to addition of organisms, and after aeration has occurred for a minimum of one hour, pH, DO and conductivity is measured directly in one replicate of each treatment and the controls, using care not to disturb the sediments.

Chironomid larvae are collected from the rearing dishes by gently touching the larvae with a brush to dislodge them from the glass surface, then pipetting the larva from the water column using a transfer pipette. The larvae are collected in 30-mL plastic containers until 10 have been randomly distributed to each.

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After the test vessels have aerated for one hour and water quality has been measured, animals are randomly allocated to treatments.

#### 4.5 Test Conditions

- photoperiod of 8 hours dark and 16 hours light, at less than 1000 lux at the water surface
- test temperature of 20°C+2°C
- organisms are fed daily; Food is a slurry of 20 g/L Nutrafin in deionized water, which has been blended using the handblender. A volume of 0.5 mL of this slurry is fed to each test vessel. If the water appears cloudy during the test, or fungus appears on the surface of the sediment, feeding should be delayed for a day, and the food ration may be reduced at the discretion of the tester. Any changes to the quantity of food must be done to all treatments.

## 4.6 Observations and Measurements

- daily temperatures are recorded from the thermometer in the area (during daily monitoring)
- all test vessels are checked to ensure that aeration is adequate and that fungus has not appeared on the sediment surface

#### 4.7 Test Termination

On day 10, a 40 mL aliquot is collected from each replicate for each treatment and pooled. The DO, pH and conductance, and if requested, hardness and alkalinity is determined from this pooled sample for every treatment. For organisms collection, the following procedure is recommended; stack the 125 and 600 µm US standard sieves together in the recirculating sediment washer. Pour 50% of the overlying water through the sieves. Swirl the remaining water to suspend the sediment. Pour the suspended sediment through the stacked sieves. Using cold dilution water, wash the contents recovered on the sieve into a glass counting tray for inspection.

Larvae may remain in sediment tubes after transfer to counting dishes. Using cold water helps to remove larvae from their sediment tubes. To remove chironomids which remain in their tubes, gently pry the tube from the larvae using two forceps. Care must be taken not to crush the larvae. Larvae are transferred to weighing dishes. Dry weight is determined by drying at 60°C for 24 hours, then weighed as a group and recorded on the data sheet.

Statistical analysis of endpoints are the NOEC and LOEC for survival and growth (weight) and LC50 and IC50 by appropriate statistical tests, dependant on data characteristics. For screening tests, significant difference for survival and weight is determined by a student's t-test between the control and test sediment.

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#### 5.0 REPORTING

A sample test report is appended. The report contains the following information:

- sample information
- date, time, and location
- description of sampling point
- test facility and conditions
- name and location of test facility
- test type and reference
- protocol deviations
- test species
- date and time of test initiation
- testers
- initial sample pH, temperature, DO, and conductance
- indication of aeration
- information of test design (volumes, loading density)
- mortality and dry weight at 10 days
- LC_{so} for multiple dilution tests plus 95% confidence limits
- method of endpoint estimation

The following information is held on file:

- sediment
- sample description and information on sign-in sheet
- test facility and conditions
- standard operating procedures
- information on test organisms (source, acclimation, feeding, etc.)
- dilution water quality
- layout and operation of test facility
- bench sheets and electronic reports

#### 6.0 QUALITY ASSURANCE

Criteria for a Valid Test

-control mortality must not exceed 30%

#### 7.0 REFERENCES

Guidance for the Collection, Handling, Transport, Storage, and Manipulation of Sediments for Chemical Characterization and Toxicity Testing. 1993. Third Draft. Environment Canada, GC048.

Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates.

WRITTEN: 94/11/18 BY: DL REVISED: 95/01/22 BY: DL



1993. Annual Book of ASTM Standards, vol. 11.04. Water and Environmental Technology. E1383-93.



WRITTEN: 94/11/18 BY: DL REVISED: 95/01/22 BY: DL

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## 8.0 APPENDIX - PREPARATION OF ARTIFICIAL SEDIMENT

- 1) Wash sand, sieve, and retain the following two size groups: medium (0.5 to 0.25 mm) and fine (0.25 to 0.05 mm). Sand should be mixed at a ratio of 2:1, fine:medium.
- 2) Clay and silt fractions are obtained using ASP 400. Other clays or silts (e.g. Attagel 50, ASP 400P, ASP 600, ASP 900, montmorillonite) might be used if specific characteristics are required.
- Organic matter (peat, humus, or cow manure) should be dried, milled and passed through a 0.84 mm sieve. Note that peat moss should be kept moist and added based on determined moisture content. If peat moss dries out, it will not rehydrate, and will float on the surface of the water.
- 4) Either CaMg(CO₃)₂ or CaCO₃ should be added to buffer the sediments.
- 5) All constituents are mixed on a percent dry weight basis. Mix in the following ratios: sand (77%); silt/clay (17%); organic matter (5%); buffer (1%).



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# Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates¹

This standard is issued under the fixed designation E 1383; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (c) indicates an editorial change since the last revision or reapproval.

#### 1. Scope

1.1 This guide covers procedures for obtaining laboratory data to evaluate adverse effects of contaminants associated with whole sediment on freshwater organisms. The methods are designed to assess the toxic effects on invertebrate survival, growth, or reproduction, from short (for example, 10 days) or long-term tests, in static or flow-through water systems. Sediments to be tested may be collected from field sites or spiked with known compounds in the laboratory. Test procedures are described for (1) Hyalella azteca, (2) Chironomus tentans, (3) Chironomus riparius, and (4) Daphnia sp. and Ceriodaphnia sp. Methods described in this document should also be useful for conducting sediment toxicity tests with other aquatic species, although modifications may be necessary.

1.2 Modification of these procedures might be justified by special needs. Results of tests conducted using unusual procedures are not likely to be comparable to results using this uside. Comparison of results obtained using modified and unmodified versions of these procedures might provide useful information concerning new concepts and procedures for conducting sediment toxicity tests with freshwater organisms.

1.3 The results from field collected sediments used in toxicity tests to determine a spatial or temporal distribution of sediment toxicity may be reported in terms of the biological effects on survival, growth, or reproduction (see Section 16, Calculation). In addition, these procedures are applicable to most sediments or chemicals added to sediment. Materials either adhering to sediment particles or dissolved in interstitial water can be tested. With appropriate modifications these procedures can be used to conduct sediment toxicity tests when factors such as temperature, dissolved oxygen, pH, and sediment characteristics (for example, particle size, organic carbon content, total solids) are of interest, or when there is a need to test such materials such as sewage sludge, oils and particulate matter. These methods might also be useful for conducting bioaccumulation tests.

1.4 Results of toxicity tests with test materials experimentally added to sediments may be reported in terms of an LC50 (median lethal concentration), and sometimes an EC50 (median effect concentration). Results of tests may be reported in terms of an NOEC (no observed effect concen-

tration) and LOEC (lowest observed effect concentration).

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1.5 This guide is arranged as follows:

•	
Referenced Documents	2
Terminology	3
Summary of Test Methods	4
Significance and Use	5
Interferences	
Hazards	,
<del></del>	
Apparatus	8
Overlying Water	9
Sediment Characterization	10
Test Organisms	11
Experimental Design	12
Procedure	13
Analytical Methodology .	14
Acceptability of Test	15
Calculation	16
Documentation	17

#### Annexes

Al. Hyalella azteca (Amphipoda)

A2. Chironomus tentans (Diptera)

A3. Chironomus riparius (Diptera)

A4. Daphnia sp. and Ceriodaphnia sp.

1.6 This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Specific hazard statements are given in Section 7.

#### 2. Referenced Documents

## 2.1 ASTM Standards:

D 1129 Terminology Relating to Water²

D 1193 Specification for Reagent Water²

D 4387 Guide for Selecting Grab Sampling Devices for Collecting Benthic Macroinvertebrates³

D 4447 Guide for the Disposal of Laboratory Chemicals and Samples³

D 4823 Guide for Core-Sampling Submerged, Unconsolidated Sediments⁴

E 380 Practice for Use of the International System of Units (SI) (the Modernized Metric System)⁵

E 729 Guide for Conducting Acute Toxicity Tests with Fishes, Macroinvertebrates, and Amphibians³

E 943 Terminology Relating to Biological Effects and Environmental Fate³

E 1023 Guide for Assessing the Hazard of a Material to Aquatic Organisms and Their Uses³

¹ This guide is under the jurisdiction of ASTM Committee E-47 on Biological effects and Environmental Fate and is the direct responsibility of Subcommittee E47.03 on Sediment Toxicology.

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² Annual Book of ASTM Standards, Vol 11.01.

³ Annual Book of ASTM Standards, Vol 11.04.

⁴ Annual Book of ASTM Standards, Vol 11.02. ⁵ Annual Book of ASTM Standards, Vol 14.02.

- E 1241 Guide for Conducting Early Life-Stage Toxicity Tests with Fishes³
- E 1295 Guide for Conducting Three Brood, Renewal Toxicity Tests with Ceriodaphnia Dubia³
- E 1297 Test Method for Measuring Fast Neutron Reaction Rates by Radioactivation of Niobium⁶
- E 1367 Guide for Conducting 10-day Static Sediment Toxicity Tests With Marine and Estuarine Amphipods3
- E 1391 Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing³

## 3. Terminology

3.1 The words "must", "should", "may", "can", and "might" have very specific meanings in this guide. "Must" is used to express an absolute requirement, that is, to state that the test ought to be designed to satisfy the specified conditions, unless the purpose of the test requires a different design. "Must" is only used in connection with the factors that directly relate to the acceptability of the test (see Section 15). "Should" is used to state that the specified condition is recommended and ought to be met if possible. Although a violation of one "should" is rarely a serious matter, violation of several will often render the results questionable. Terms such as "is desirable," "is often desirable," and "might be desirable" are used in connection with less important factors. "May" is used to mean "is (are) allowed to," "can" is used to mean "is (are) able to," and "might" is used to mean "could possibly." Thus, the classic distinction between "may" and "can" is preserved, and "might" is never used as a synonym for either "may" or "can."

3.2 Descriptions of Terms Specific to this Standard:

3.2.1 clean-denotes a sediment or water that does not contain concentrations of test materials which cause apparent stress to the test organisms or reduce their survival.

3.2.2 concentration—the ratio of weight or volume of test material(s) to the weight or volume of sediment.

3.2.3 interstitial water—the water within a wet sediment that surrounds the sediment particles, expressed as the percent ratio of the weight of the water in the sediment to the weight of the wet sediment.

3.2.4 overlying water—the water placed over the whole sediment in the test chamber for the conduct of the toxicity test, and may also include the water used to manipulate the sediments.

3.2.5 sediment—a naturally occurring particulate material which has been transported and deposited at the bottom of a body of water, or an experimentally prepared substrate within which the test organisms can interact.

3.2.6 spiking—the experimental addition of a test material such as a chemical or mixture of chemicals, sewage sludge, oil, particulate matter, or highly contaminated sediment to a clean negative control or reference sediment, such that the toxicity of the material added can be determined. After the test material is added, which may involve a solvent carrier, the sediment is thoroughly mixed to evenly distribute the test material throughout the sediment.

3.2.7 whole sediment—distinguished from elutriates, and

resuspended sediments, in that the whole, intact sediment is used to expose the organisms, not a form or derivative of the sediment.

3.3 Definitions-For definitions of other terms used in this guide, refer to Guides E 729, E 1023, E 1241, Terminology E 943 and D 1129. For an explanation of units and symbols, refer to Practice E 380.

# 4. Summary of Guide

4.1 The toxicity of contaminated whole sediments is assessed during continuous exposure of aquatic organisms, using either static or flow-through exposure systems. Sediments tested may either be collected from field sites or spiked with a known compound(s). A negative control sediment or a reference sediment is used to (a) give a measure of the acceptability of the test; (b) provide evidence of the health and relative quality of the test organisms; (c) determine the suitability of the overlying water, test conditions, food, handling procedures; and (d) provide a basis for interpreting data obtained from the test sediments. A reference sediment is collected from the field in a clean area and represents the test sediments in sediment characteristics (for example, TOC, particles size, pH). Specified data are obtained to determine the toxic effects on survival, growth, or reproduction, from short (for example, 10 days), or long-term exposures to aquatic invertebrates.

# 5. Significance and Use

5.1 Protection of a species requires averting detrimental contaminant related effects on the survival, growth, reproduction, health, and uses of the individuals of that species (1).7 Sediment toxicity tests provide information concerning the bioavailability of contaminants associated with sediments to aquatic organisms. Invertebrates occupy an essential niche in aquatic ecosystems and are an important food source for fish, wildlife, and larger invertebrates. A major change in the availability of invertebrates as either a food source, or as organisms functioning properly in trophic energy transfer and nutrient cycling, could have serious adverse ecological effects on the entire aquatic system.

5.2 Results from sediment toxicity tests might be an important consideration when assessing the hazards of materials on aquatic organisms (see Guide E 1023) or when deriving sediment quality concentrations for aquatic organisms (2).

5.3 Information might also be obtained on accumulation of contaminants associated with sediments by analysis of animal tissues for the contaminant(s) being monitored.

5.4 The sediment toxicity test might be used to determine the temporal or spatial distribution of sediment toxicity. Test methods can be used to detect horizontal and vertical gradients in toxicity.

5.5 Results of sediment toxicity tests with test materials experimentally added to sediments could be used to compare the sensitivities of different species, the toxicity of different test materials, and to study the effects of various environmental factors or results of such tests. Results of sediment

⁶ Annual Book of ASTM Standards, Vol 12.02.

⁷ The boldface numbers in parentheses refer to a list of references at the end of this standard.

toxicity tests are useful for studying biological availability of test materials, and structure-activity relationships.

5.6 Results of sediment toxicity tests can be used to redict effects likely to occur with aquatic organisms in field situations as a result of exposure under comparable conditions, except that (a) motile organisms might avoid exposure and (b) toxicity to benthic organisms can be dependent on sediment physical characteristics, dynamics of equilibrium partitioning, and the route of exposure.

5.6.1 Field surveys can be designed to provide either a qualitative reconnaissance of the distribution of sediment toxicity or a quantitative statistical comparison of toxicity

among sites.

- 5.6.2 Sediment toxicity surveys are usually part of more comprehensive analyses of biological, chemical, geological, and hydrographic conditions. Statistical correlation can be improved and costs reduced if subsamples for sediment toxicity tests, geochemical analyses, and benthic community structure are taken simultaneously from the same grab of the same site.
- 5.7 Sediment toxicity tests can be an important tool for making decisions regarding the extent of remedial action needed for contaminated aquatic sites.

#### 6. Interferences

6.1 Limitations to the methods described in this guide might arise and thereby influence sediment toxicity test results and complicate data interpretation. The following factors should be considered when testing whole sediments:

6.1.1 Alteration of field samples in preparation for labo-

hory testing (for example, sieving),

- 6.1.1.1 Maintaining the integrity of the sediment environment during its removal, transport, and testing in the laboratory is extremely difficult. The sediment environment is composed of a myriad of microenvironments, redox gradients and other interacting physiochemical and biological processes. Many of these characteristics influence sediment toxicity and bioavailability to benthic and planktonic organisms, microbial degradation, and chemical sorption. Any disruption of this environment complicates interpretations of treatment effects, causative factors, and in situ comparisons.
- 6.1.1.2 Sediments tested at temperatures other than that at which they are collected might affect contaminant solubility, partitioning coefficients, and other physical and chemical characteristics.
- 6.1.2 Interaction between sediment and overlying water and the influences of the ratio of sediment to overlying water,
- 6.1.3 Interaction among chemicals present in the sediment.
- 6.1.4 Use of laboratory spiked sediment that might not be representative of contaminants associated with sediments in the field,
- 6.1.5 Maintenance of acceptable quality of overlying water,
- 6.1.6 Addition of food (3) or solvents to the test chambers that might obscure the adverse influence of contaminants sociated with sediment, provide an organic substrate for acterial or fungal growth, and might affect water quality characteristics (4),
  - 6.1.7 Resuspension of sediment during the toxicity test,

6.1.8 Natural geochemical properties of test sediment collected from the field that might not be within the tolerance limits of the test species,

6.1.9 Recovery of test organisms from the sediment.

6.1.10 Field collected sediments that may contain indigenous organisms including predators, the same or closely related species to that being tested, and microorganisms (for example, bacteria and molds) and algae species that might grow in or on the sediment and test chamber surfaces, and

6.1.11 Test material concentrations that might be reduced in the overlying water in flow-through testing, and compounds such as ammonia that might increase during testing.

6.2 Static tests might not be applicable with materials that are highly volatile or rapidly transform biologically or chemically. The dynamics of test material partitioning between solid and dissolved phases at the start of the test should therefore be considered, especially in relation to assumptions of chemical equilibria.

#### 7. Hazards

7.1 Many substances pose health risks to humans if adequate precautions are not taken. Information on toxicity to humans, recommended handling procedures, and chemical and physical properties of the test material should be studied before a test is begun and made aware to all personnel involved (5, 6, 7, 8). Contact with test materials, overlying water and sediments should be minimized.

7.1.1 Many materials can adversely affect humans if precautions are inadequate. Skin contact with test materials and solutions should be minimized by such means as wearing appropriate protective gloves, laboratory coats, aprons, and safety glasses, and by using dip nets, sieves or tubes to remove test organisms from overlying water. When handling hazardous sediments the proper handling procedures might include sieving and distributing sediments under a ventilated hood or in an enclosed glove box, enclosing and ventilating the toxicity testing water bath, and use of respirators, aprons, safety glasses, and gloves. Field collected sediments might contain toxic materials and should be treated with caution to minimize occupational exposure to workers. Worker safety should also be considered when working with spiked sediments containing organics or inorganic contaminants, those that are radio-labeled, and with materials that are, or are suspected of being, carcinogenic (7).

7.2 Careful considerations should be given to those chemicals which might biodegrade, transform to more toxic components, volatilize, oxidize, or photolyze during the test

period.

7.3 For tests involving spiked sediments with known test materials, removal or degradation of test material before disposal of stock solutions, overlying water, and sediments is sometimes desirable.

7.4 Health and safety precautions and applicable regulations for disposal of stock solutions, test organisms, sediments, and overlying water should be considered before beginning a test (see Guide D 4447).

7.5 Cleaning of equipment with a volatile solvent such as acetone should be performed only in a well-ventilated area in which no smoking is allowed and no open slame such as a pilot light is present.

7.6 An acidic solution should not be mixed with a

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hypochlorite solution because hazardous fumes might be produced.

7.7 To prepare dilute acid solutions, concentrated acid should be added to water, not vice versa. Opening a bottle of concentrated acid and adding concentrated acid to water should be performed only in a fume hood.

7.8 Use of ground fault systems and leak detectors is strongly recommended to help prevent electrical shocks.

# 8. Apparatus

8.1 Facilities—The facility should include constant temperature areas for culturing and testing to reduce the possibility of contamination by test materials and other substances, especially volatile compounds. Holding, acclimation, and culture tanks should not be in a room in which toxicity tests are conducted, stock solutions or test solutions are prepared, or equipment is cleaned. Test chambers may be placed in a temperature controlled recirculating water bath or a constant-temperature area. Air used for aeration should be free of fumes, oil, and water. Filters to remove oil, water, and bacteria are desirable. Air filtration through a 0.22 μm bacterial filter or other suitable system may be used. The test facility should be well ventilated and free of fumes. Enclosures might be desirable to ventilate test chambers.

8.1.1 If a photoperiod other than continuous light is used, a timing device should be used to provide a light:darkness cycle. A 15- to 30-min transition period (9) when lights go on and off might be desirable to reduce the possibility of test organisms being stressed by instantaneous illumination; a transition period when lights go off might also be desirable.

8.2 Construction Materials—Equipment and facilities that contact stock solutions, test solutions, sediment and overlying water, into which test organisms will be placed, should not contain substances that can be leached or dissolved in amounts that adversely affect the test organisms. In addition, equipment and facilities that contact sediment or water should be chosen to minimize sorption of test materials from water. Glass, type 316 stainless steel, nylon, high density polyethylene, polycarbonate and fluorocarbon plastics should be used whenever possible to minimize leaching, dissolution, and sorption. Concrete and rigid (unplasticized) plastics may be used for holding, acclimation, and culture tanks, and in the water-supply system, but these materials should be soaked, preferably in flowing water, for a week or more before use (10). Cast-iron pipe should probably not be used in freshwater-supply systems because colloidal iron will be added to the overlying water and strainers will be needed to remove rust particles. Copper, brass, lead, galvanized metal, and natural rubber should not contact overlying water or stock solutions before or during the test. Items made of neoprene rubber and other materials not mentioned above should not be used unless it has been shown that their use will not adversely affect survival, growth, or reproduction of the test organisms.

8.3 Water Delivery System—The water delivery system used in flow-through testing can be one of several designs. The system should be capable of delivering water to each replicate test chamber. Several designs of diluter systems are currently in use; Mount and Brungs (11) diluters have been successfully modified for sediment testing and other diluter systems have also been useful according to Ingersoll and

Nelson (4) and Maki (12). Various metering systems, using different combinations of siphons, pumps, solenoids, valves, etc., have been used successfully to control the flow rates of overlying water.

8.3.1 The metering system should be calibrated before the test by determining the flow rate of the overlying water through each test chamber. The general operation of the metering system should be visually checked daily throughout the conduct of the test. If necessary, the water delivery system should be adjusted during the test. At any particular time during the test, flow rates through any two test chambers should not differ by more than 10 %.

8.4 Test Chambers:

8.4.1 In a toxicity test with aquatic organisms, test chambers are defined as the smallest physical units between which there are no water connections. However, screens, cups, etc., may be used to create two or more compartments within each chamber. Therefore, the overlying water can flow from one compartment to another within a test chamber but, by definition, cannot flow from one chamber to another. All test chambers and compartments if used, in a sediment toxicity test, must be identical. For the static tests, cover watch glasses may be used to fit over the top of the test chambers such that an aeration tip is accommodated.

8.4.2 Test chambers may be constructed in several ways of various materials, depending on the experimental design and the contaminants of interest. Clear silicone adhesives, suitable for aquaria, sorb some organic compounds which might be difficult to remove. Therefore, as little adhesive as possible should be in contact with test solution. If extra beads of adhesive are needed, they should be on the outside of the test chambers rather than on the inside. To leach potentially toxic compounds from the adhesive, all new test chambers constructed using silicone adhesives should be acclimated at least 48 h in overlying water used in the sediment toxicity

8.4.3 Species-specific information on test chambers is given in Annexes Al through A4.

8.5 Cleaning:

8.5.1 Test chambers, water delivery systems, equipment used to prepare and store overlying water, and stock solutions should be cleaned before use. New items should be washed in the following manner: (a) detergent wash, (b) water rinse, (c) water-miscible organic solvent wash, (d) water rinse, (e) acid wash (such as 10 % concentrated hydrochloric acid), and (/) rinsed at least twice with distilled, deionized, or overlying water. Test chambers should be rinsed with overlying water just before use.

8.5.2 Many organic solvents leave a film that is insoluble in water. A dichromate-sulfuric acid cleaning solution can generally be used in place of both the organic solvent and the acid (see Guide E 729), but the solution might attack silicone

adhesive and leave chromium residues on glass.

8.5.3 Upon completion of a test, all items to be used again should be immediately emptied of sediment and overlying water (and properly disposed), rinsed with water, cleaned by a procedure appropriate for removing the test material (for example, acid to remove metals and bases; detergent, organic solvent, or activated carbon to remove organic chemicals) and rinsed at least twice with distilled, deionized, or overlying water, in that order.

8.6 Acceptability—Before a toxicity test is conducted in new test facilities, it is desirable to conduct a "non-toxicant" it, in which all test chambers contain a negative control or terence sediment, and overlying water with no added test material. Survival, growth, or reproduction of the test species will demonstrate whether facilities, water, control sediment, and handling techniques are adequate to result in acceptable species-specific control numbers. The magnitude of the within-chamber and between-chamber variance should also be determined.

#### 9. Overlying Water

9.1 Requirements—Besides being available in adequate supply, overlying water used in toxicity tests, and water used to hold organisms before testing, should be acceptable to test species and uniform in quality. To be acceptable to the test species, the water must allow satisfactory survival and growth, without showing signs of disease or apparent stress, such as discoloration, or unusual behavior.

9.2 Source:

9.2.1 Natural overlying water should be uncontaminated and of constant quality and should meet the following specifications as established in Guide E 729. The values stated help to ensure that test organisms are not apparently stressed during holding, acclimation, and testing, and that test results are not unnecessarily affected by water quality characteristics:

Particulate matter CS mg/L COD CS mg/L Residual chlorine C11 µg/L

9.2.1.1 A natural overlying water is considered to be of uniform quality if the monthly ranges of the hardness, alkalinity, and specific conductance are less than 10 % of their respective averages and if the monthly range of pH is less than 0.4 unit. Natural overlying waters should be obtained from an uncontaminated well or spring, if possible, or from a surface water source. If surface water is used, the intake should be positioned to minimize fluctuations in quality and the possibility of contamination and maximize the concentration of dissolved oxygen and to help ensure low concentrations of sulfide and iron. Municipal water supplies often contain unacceptably high concentrations of copper, lead, zinc, fluoride, chlorine or chloramines, and quality is often variable (13). Chlorinated water should not be used for, or in the preparation of, overlying water because residual chlorine and chlorine-produced oxidants are toxic to many aquatic animals (14). Dechlorinated water should only be used as a last resort, because dechlorination is often incom-

- 9.2.2 For certain applications the experimental design might require use of water from the test sediment collection site.
- 9.2.3 Reconstituted water is prepared by adding specified amounts of reagent grade⁸ chemicals to high quality distilled

or deionized water (see Guide E 729). Acceptable water can be prepared using deionization, distillation, or reverse-osmosis units. Conductivity, pH, hardness and alkalinity should be measured on each batch of reconstituted water. If the water is prepared from a surface water, total organic carbon or chemical oxygen demand should be measured on each batch. Filtration through sand, rock, bag, or depth-type cartridge filters may be used to keep the concentration of particulate matter acceptably low. The reconstituted water should be intensively aerated before use, except that buffered soft fresh waters should be aerated before, but not after, addition of buffers. Problems have been encountered with some species in some fresh reconstituted waters, but these problems can be overcome by aging the reconstituted water for one or more weeks.

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9.3 Characterization:

9.3.1 The following items should be measured at least twice each year, and more often if such measurements have not been determined semiannually for at least two years, or if surface water is used: pH, particulate matter, TOC, organophosphorus pesticides, organic chlorine (or organochlorine pesticides plus PCBs), chlorinated phenoxy herbicides, ammonia, cyanide, sulfide, bromide, chloride, fluoride, iodide, nitrate, phosphate, sulfate, calcium, magnesium, sodium, potassium, aluminum, arsenic, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, and zinc, hardness, alkalinity, and conductivity (see Guide E 729).

9.3.2 For each method used the detection limit should be below the concentration in the overlying water, or below the lowest concentration that has been shown to adversely affect

the test species (14).

9.3.3 Water that might be contaminated with facultative pathogens may be passed through a properly maintained ultraviolet sterilizer (15) equipped with an intensity meter and flow controls or passed through a filter with a pore size of 0.45 µm or less.

9.3.4 Water might need intense aeration using air stones, surface aerators, or column aerators (16, 17, 18). Adequate aeration will stabilize pH, bring concentrations of dissolved oxygen and other gases into equilibrium with air, and minimize oxygen demand and concentrations of volatiles. The concentration of dissolved oxygen in water should be between 90 % and 100 % saturation (19) to help ensure that dissolved oxygen concentrations are acceptable in test chambers.

#### 10. Sediment Characterization

10.1 General—Before the preparation or collection of sediment an approved written procedure should be prepared for the handling of sediments which might contain unknown quantities of toxic contaminants (see Section 7, Hazards). All sediments should be characterized and at least the following determined: pH, organic carbon content (total organic carbon TOC) or total volatile sulfides, particle size distribution (percent sand, silt, clay), and percent water content (20, 21). Other analyses on sediments might include biological oxygen demand, chemical oxygen demand, cation exchange capacity, Eh, pE, total inorganic carbon, total volatile solids, acid volatile sulfides, total ammonia, metals, organosilicones, synthetic organic compounds, oil and grease, petroleum hydrocarbons, and interstitial water analysis. Macrobenthos

^{* &}quot;Reagent Chemicals, American Chemical Society Specifications," Am. Chemical Soc., Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards," by Joseph Rosin, D. Van Nostrand Co., Inc., New York, NY, and the "United States Pharmacopeia."

may be determined by a subsample of the field collected sediment. Toxicological results might provide information directing a more intensive analysis. Sediment toxicity testing procedures are detailed in Section 13, Procedures.

10.2 Negative Control and Reference Sediment—A negative control sediment or a reference sediment is used to (a) give a measure of the acceptability of the test, (b) provide evidence of the health and relative quality of the test organisms, (c) determine the suitability of the overlying water, test conditions, food, handling procedures, and (d) provide a basis for interpreting data obtained from the test sediments. Every test requires a negative sediment control (sediment known to be nontoxic to, and within the geochemical requirements of the test species) or a reference sediment. A reference sediment should be collected from the field in a clean area and represent the test sediment in sediment characteristics (for example, TOC, particles size,

pH). This provides a site-specific basis for comparison of

toxic and non-toxic conditions. The same overlying water,

conditions, procedures, and organisms should be used as in

the other treatments, except that none of the test material(s)

being tested, or contaminated field collected sediments, is

added to the negative control or reference sediment test

chambers.
10.2.1 If a field sediment has properties such as grain size and organic content that might exceed the tolerance range of the test species, it is desirable to include a reference sediment for these characteristics.

10.3 Field Collected Test Sediment:

10.3.1 Collection (see Section 7, Hazards)—A benthic grab or core should be used rather than a dredge to minimize disruption of the sample (see Guides D 4387 and E 1391). If the sediment is obtained with a grab, it is preferable to collect a sediment sample from the upper 2 cm. This operation is facilitated if the grab can be opened from the top so that the undisturbed sediment surface is exposed. The sample should be transferred to a clean (see 8.5) sample container. If the contaminants associated with sediments include compounds that readily photolyze, minimize direct sunlight during collection. All sediment samples should be cooled to  $4 \pm 2^{\circ}$ C in the field.

± 2°C and for no longer than two weeks before the start of the test. Freezing and longer storage might change sediment properties and should be avoided (see Guide E 1391). Sediment may be stored in containers constructed of suitable quality as outlined in 8.2. It is desirable to avoid contact with metals, including stainless steel and brass sieving screens, and some plastics. The samples should be thoroughly mixed and may be wet-press sieved through a suitably sized sieve to remove large particles and indigenous organisms, especially predators. Sediment may be diluted and mixed in a 1 to 1 ratio with overlying water to facilitate sieving (22) (see Section 6, Interferences).

10.3.3 If the experimental design prescribes not sieving a field collected sediment, obvious large predators or other large organisms should be removed by using forceps. If sediment is to be collected from multiple field samples and pooled to meet technical objectives, the sediment should be thoroughly homogenized by stirring, or with the aid of a

rolling mill, feed mixer, or other suitable apparatus (see Guide E 1391).

10.3.4 Additional samples may be taken from the same grab for other kinds of sediment analyses (see 10.1). Qualitative descriptions of the sediment may include color, texture, presence of macrophytes, animals, tracks, and burrows. Monitoring the odor of sediment samples should be avoided because of hazardous volatile contaminants (see Section 7, Hazards).

10.3.5 The natural geochemical properties of test sediment collected from the field must be within the tolerance limits of the test species. The limits for the test species should be determined experimentally in advance (see 10.2). Controls for such factors as particle size distribution, organic carbon content, pH, etc., should be run if the limits are exceeded in the test sediments (23).

10.4 Laboratory Spiked Sediment—Test sediment can also be prepared in the laboratory by manipulating the properties of the negative control or the reference sediment. This can include adding chemicals or complex waste mixtures (see 1.4) (24). The toxicity of substances either dissolved in the interstitial water or adsorbed to sediment

particles can be determined experimentally.

10.4.1 The test material(s) should be reagent grade⁷ or better, unless a test on formulation commercial product (25), or technical-grade or use-grade material is specifically needed. Before a test is started, the following should be known about the test material: (a) the identity and concentration of major ingredients and impurities, (b) water solubility in test water, (c) estimated toxicity to the test species and to humans, (d) precision and bias of the analytical method at the planned concentration(s) of the test material, if the test concentration(s) are to be measured, and (e) recommended handling and disposal procedures. The toxicity of the test material in sediments may be quite different from the toxicity in water borne exposures.

10.4.2 Stock Solution(s)—Test material(s) to be tested in sediment should be dissolved in a solvent to form a stock solution that is then added to the sediment. The maximum concentration of the solvent in the sediment should be at a concentration that does not affect the test species. The concentration and stability of the chemical in the stock solution should be determined before beginning the test. If the chemical(s) is subject to photolysis, the stock solution should be shielded from the light both before and during the process of mixing into the sediment. If a solvent other than water is necessary (the preferred solvent is water), it should be one which can be driven off (for example, evaporated) leaving only the test chemical on the sediments. Concentrations of the chemical in the water and sediment should be monitored before the test begins.

10.4.3 If a solvent other than water is used, both a sediment solvent control and a sediment negative control or reference sediment must be included in the test. The solvent control must contain the highest concentration of solvent present and must use solvent from the same batch used to make the stock solution (see Guide E 729). The same concentration of solvent should be used in all treatments.

10.4.3.1 Triethylene glycol is often a good organic solvent for preparing stock solutions because of its low toxicity to aquatic animals, low volatility, and ability to dissolve many

organic chemicals. Other water-miscible organic solvents, such as methanol, ethanol or acetone may be used, but they the affect total organic carbon levels, introduce toxicity, were the geochemical properties of the sediment, or stimulate undesirable growths of microorganisms (see Section 6, Interferences). Acetone is highly volatile and might leave the system more readily than methanol or ethanol. A surfactant should not be used in the preparation of a stock solution because it might affect the bioavailability, form and toxicity of the test material.

10.4.4 If the concentration of solvent is not the same in all test solutions that contain test material, either a solvent test should be conducted to determine whether survival, growth, or reproduction of the test organisms is related to the concentration of the solvent over the range used in the toxicity test, or such a solvent test already conducted using the same overlying water and test species. If survival, growth, or reproduction is found to be related to the concentration of solvent, a sediment toxicity test with that species in that amount of solvent is unacceptable if any treatment contained a concentration of solvent in that range.

10.4.4.1 If the test contains both a negative control and a solvent control, the survival, growth, or reproduction of the organisms tested in the two controls should be compared (see Guide E 1241). If a statistically significant difference in either survival, growth, or reproduction is detected between the two controls, only the solvent control may be used for meeting the acceptability of the test and as the basis for calculation of results. The negative control might provide litional information on the general health of the organisms tested. If no statistically significant difference is detected, the data from both controls should be used for meeting the acceptability of the test and as the basis for calculation of results (see 9.2.4.3 of Guide E 1241).

10.4.5 Test Concentration(s) for Laboratory Spiked Sediments:

10.4.5.1 If the test is intended to allow calculation of an LC50, the test concentrations should bracket the predicted LC50. The prediction might be based on the results of a test on the same or a similar test material on the same or a similar species. The LC50 of a particular compound may vary depending on physical and chemical sediment characteristics. If a useful prediction is not available, it is desirable to conduct a range-finding test in which the organisms are exposed to a control and three or more concentrations of the test material that differ by a factor of ten.

10.4.5.2 If necessary, concentrations above aqueous solubility can be used, as indigenous organisms are at times exposed to concentrations above solubility in the real world (see Guide E 729).

10.4.5.3 Bulk sediment chemical concentrations might be normalized to factors other than dry weight. For example, concentrations of non-polar organic compounds might be normalized to sediment organic carbon content, and metals normalized to acid volatile sulfides.

10.4.5.4 In some situations (for example, regulatory) it ght be necessary to only determine whether a specific concentration of test material is toxic to the test species, or whether the LC50 is above or below a specific concentration. When there is interest in a particular concentration, it might

only be necessary to test that concentration and not to determine the LC50.

10.4.6 Addition of test material(s) to sediment may be accomplished using various methods, such as a (a) rolling mill, (b) feed mixer, or (c) hand mixing (see Guide E 1391).

10.4.6.1 Modifications of the mixing techniques might be necessary to allow time for a test material to equilibrate with the sediment. If tests are repeated, mixing conditions such as duration and temperature of mixing, and time of mixing before the test starts, should be kept constant. Care should be taken to ensure that a test material added to sediment is thoroughly and evenly distributed within the sediment. If necessary, subsamples of the sediment within a mixing container can be analyzed to determine degree of mixing and homogeneity.

## 11. Test Organisms

should be conducted with species listed in the Appendices. Use of these species is encouraged to increase comparability of results. The source and type of sediment being tested or the type of test to be implemented might dictate selection of a particular species. The species used should be selected based on availability, sensitivity to a test material(s), and tolerance to ecological conditions such as temperature, grain size, and ease of handling in the laboratory. The species used should be identified using an appropriate taxonomic key.

11.2 Age—All organisms should be as uniform as possible in age and size class. The age or size class for a particular test species should be chosen so that sensitivity to test materials is not affected by state of maturity, reproduction, or other intrinsic life-cycle factors (see Annexes A1 through A4).

11.3 Source—All organisms in a test must be from the same source. Organisms may be obtained from laboratory cultures, commercial, state or federal institutions, or natural populations from clean areas. Laboratory cultures of test species can provide organisms whose history, age, and quality are known. Local and state agencies might require collecting permits.

11.4 Quality—Analysis of the test organisms for the test material(s) is desirable, as it might be present in the environment, and other chemicals to which major exposure might have occurred.

11.5 Brood Stock—Brood stock should be cared for properly so as not to be unnecessarily stressed (see Annexes Al through A4). To maintain organisms in good condition and avoid unnecessary stress, they should not be crowded and should not be subjected to rapid changes in temperature or water quality characteristics.

11.6 Handling—Test organisms should be handled as little as possible. When handling is necessary, it should be done as gently, carefully, and as quickly as possible. Organisms should be introduced into solutions beneath the airwater interface. Any organisms that touch dry surfaces, are dropped, or injured during handling should be discarded.

#### 12. Experimental Design

12.1 Decisions concerning the various aspects of experimental design, such as the number of treatments, number of test chambers and test organisms per treatment, and water quality characteristics, should be based on the purpose of the

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test and the type of procedure that is to be used to calculate results (see Section 16, Calculation). A test intended to allow calculation of a specific endpoint such as an LC50 should consist of a negative control sediment, a solvent control(s), a reference sediment, and several test sediments (see Section 10, Sediment Characterization).

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12.2 The object of a qualitative reconnaissance survey is to identify sites of toxic conditions that warrant further study. It is often conducted in areas where little is known about contamination patterns. To allow for maximum spatial coverage, the survey design might include only one sample from each site. The lack of replication usually precludes statistical comparisons, but identification of samples for further study is possible, where survival, growth, or reproduction differ from the negative control or reference sediment. A useful summary of field sampling design is presented by Green (26).

12.2.1 The object of a quantitative statistical comparison is to test for statistically significant differences in effects (see 13.12) among negative control or reference sediments and test sediments from several sites. The number of replicates needed per site is a function of the need for sensitivity or power. Replicates (for example, separate samples from different grabs taken at the same site) should be taken at each site in the survey. Separate subsamples from the same grab might be used to test for within-grab variability, or split samples of composited sediment from one or more grabs might be used for comparisons of test procedures (such as comparative sensitivity among test species), but these subsamples should not be considered to be true replicates for statistical comparisons among sites.

12.2.2 Site locations might be distributed along a known pollution gradient, in relation to the boundary of a disposal site, or at sites identified as being toxic in a reconnaissance survey. Comparisons can be made in both space and time (see Section 16, Calculation). In pre-dredging studies, a sampling design can be prepared to assess the toxicity of samples representative of the project area to be dredged. Such a design should include subsampling cores taken to the

project depth. 12.3 Laboratory Experiments-The primary focus of the physical and experimental test design, and statistical analysis of the data, is the experimental unit, which is defined as the smallest physical entity to which treatments can be independently assigned (27). Because overlying water or air cannot flow from one test chamber to another the test chamber is the experimental unit (see 8.4). As the number of test chambers per treatment increases, the number of degrees of freedom increases, and, therefore, the width of the confidence interval on a point estimate, such as an LC50, decreases, and the power of a significance test increases (see Section 16, Calculation). Because of factors that might affect results within test chambers and results of the test: (a) all test chambers should be treated as similarly as possible, such as temperature and lighting (unless these are the variables tested), and (b) each test chamber, including replicate test chambers, must be physically treated as a separate entity. Treatments must be randomly assigned to individual test chamber locations. Assignment of test organisms to test chambers must be randomized.

#### 13. Procedure

13.1 Sediment into Test Chambers—The day before the toxicity test is started (Day -1) each test sediment, reference sediment, and negative control sediment should be mixed and a sample added to the test chambers (4, 24, 28). Sediment depth in the test chamber is dependent on the experimental design and the test species (see Annexes Al through A4 and 6.1.2). Each test chamber and replicates must contain the same amount of sediment, determined either by volume or weight.

13.1.1 The sediment aliquot in each test chamber should be settled by smoothing with a utensil constructed of a suitable material (see 8.2). If beakers are used, bubbles can be removed by either tapping the test chamber against the palm of the hand or by displacement of bubbles with the utensil. After the sediment is placed in the test chambers, overlying water should be added. The overlying water should be gently poured along the side of the test chamber to prevent

resuspension of the sediment.

13.2 Static Testing—Overlying water should be added to the test chambers at the volume specified by the experimental design. Watch glasses should be used to cover the test chambers and overlying water gently aerated. Aeration can be provided to each test chamber through a 1-mL glass pipet that extends between the beaker spout and the watch glass cover to a depth not closer than 2 cm from the sediment surface. Air should be bubbled into the test chambers at a rate that does not cause turbulence or disturb the sediment surface. To allow any suspended sediments to settle, the test organisms should not be introduced into the test system for between 12 and 24 h. Water quality characteristics should be measured prior to the addition of the test organisms (see 13.11).

13.2.1 Water lost to evaporation or splattering should be replaced as needed with temperature acclimated de-ionized water or overlying water. The water quality of the overlying water in static sediment toxicity tests (water hardness, alkalinity, total dissolved solids, and dissolved oxygen) might be altered by the presence of sediment (4) or by the addition of food to the test chamber (3). These changes in water quality characteristics might influence the availability of contaminants to the test organisms (see Section 6, Interferences).

13.3 Flow-Through Testing—The water-delivery system should be turned on before a test is started to verify that the system is functioning properly. The water flow to each test chamber should not differ by more than 10 % (see 8.3.1). The total volume flow per hour for continuous flow diluters should be recorded.

13.3.1 After the sediment has been added (Day -1), overlying water is added to the test chambers (see 13.2). After aliquots are removed for water quality determinations (Day 0), overlying water flow is started prior to the addition of the test organisms and food (4).

13.4 Duration of Test—The test begins when test organisms are first placed in the test chambers (Day 0) and continues for the duration specified in the experimental design for a specific test organism (see Annexes A1 through A4).

13.5 Dissolved Oxygen—The dissolved oxygen concentration in each test chamber should be measured in at least one test chamber in each treatment (a) at the beginning and end of the test and at least weekly (if possible) during the test, (b)

whenever there is an interruption of the flow of air (static tests) or water (flow-through tests), and (c) whenever the behavior of the test organisms indicates that the dissolved oxygen concentration might be too low (for example, emergence from the sediment). A measured dissolved oxygen concentration should be >40% and  $\le 100\%$  saturation (12.4.2 of Guide E 729).

13.6 Overlying Water Quality Measurements—Conductivity, hardness, pH, and alkalinity should be measured in all treatments at the beginning and end of a short-term test, and at least weekly during a long-term test, using appropriate ASTM standards when possible.

13.7 Temperature—Test temperature depends upon the species used (see Annexes A1 through A4). Other temperatures may be used to study the effect of temperature on survival, growth, or reproduction of test organisms, and contaminant related properties (for example, bioavailability). The daily mean test temperature must be within  $\pm 1^{\circ}$ C of the desired temperature. The instantaneous temperature must always be within  $\pm 3^{\circ}$ C of the desired temperature.

13.8 Feeding—Recommended food, ration, method, and frequency of feeding test organisms are contained in Annexes A1 through A4. The food used should be analyzed for the test material and other possible contaminants. A batch of food may be used if it will support normal function. Detailed records on feeding rates and appearance of the sediment should be made daily.

13.9 Debris—Any floating debris may be skimmed from the test chambers before test organisms are added. This can be accomplished with a piece of fine nylon screen or other suitable material. If more than 0.1 g of floating debris is removed, an analysis should be performed to determine the amount of chemical removed from the system (25).

13.10 Light—For sediment toxicity tests various light:darkness regimes can be used depending on the species being tested (see Annexes A1 through A4) and various experimental designs.

13.11 Acclimation—Test organisms should be acclimated if they are cultured in water different from the overlying water or temperature (4) (see Annexes A1 through A4).

13.12 Biological Data—Effects indicating toxicity of test sediment include mortality and sublethal effects on growth, maturation, behavior, and reproduction. Test chambers should be observed at least daily. At the end of the exposure period, recovery of the test organisms from sediments should be accomplished following the methods outlined for each species (see Annexes A1 through A4).

#### 13.13 Other Measurements:

13.13.1 Field Sediment—Sediment samples should be collected from the same grab for analysis of sediment physical and chemical characterizations. A separate sample for benthic faunal analyses may be desirable (see Guide D 4387).

13.13.2 Laboratory Spiked Sediments—At the beginning and at the end of the experiment, measurement of the concentration of the test material(s) in both stock solutions and sediment is desirable. To monitor changes in sediment or interstitial water chemistry during the course of the experiment, separate sediment chemistry chambers should be set up and sampled at the start and end of the experiment. It is not necessary to add test organisms to these chambers at

the beginning of the test, but for later sampling, test organisms should be added after the initial sample is taken.

13.13.2.1 Concentration of test material(s) in overlying water, interstitial water, and sediment should be measured at several concentrations and as often as practical during the test. If possible, the concentration of the test material in overlying water, interstitial water and sediments should be measured at the start and end of the test. Measurement of test material(s) degradation products might also be desirable.

13.13.2.2 Measurement of test material(s) concentration in water can be accomplished by pipeting water samples from a point midway between top, bottom and sides of the test chamber. Overlying water samples should not contain any surface scum, any material from the sides of the test chamber, or any sediment.

13.13.2.3 Measurement of test material(s) concentration in sediment at the end of a test can be taken by siphoning the overlying water without disturbing the surface of the sediment, then removing appropriate aliquots of the sediment for chemical analysis.

13.13.2.4 Interstitial water can be sampled by using the water that (a) comes to the surface in a mixing apparatus, (b) is on the surface of the sediment after it settles, (c) is separated from the sediment particles by centrifuging a sediment sample, (d) is filtered through an apparatus to extract interstitial water, (e) has been pressed out of the sediment, or (f) by using an interstitial water sampler. Care should be taken to ensure that contaminants do not transform, degrade, or volatilize during the interstitial water sample preparation (see Guide E 1391).

#### 14. Analytical Methodology

14.1 Chemical and physical data should be obtained using appropriate ASTM standards whenever possible. For those measurements for which ASTM standards do not exist or are not sensitive enough, methods should be obtained from other reliable sources (29).

14.2 Concentrations should be measured for contaminants in bulk sediment, test material(s) in the interstitial water, test material(s) in the overlying water, and test material(s) in the stock solution. In addition, measurement of either the apparent dissolved or undissolved substances of the test material(s) is desirable. The apparent dissolved material is defined and determined as that which passes through a 0.45 µm membrane filter.

14.2.1 If samples of overlying water from test chambers, stock solutions, test sediment, or interstitial water are not to be analyzed immediately, they should be handled and stored appropriately (30) (see Section 10, Sediments).

14.3 Methods used to analyze food or test organisms should be obtained from appropriate sources (31).

14.4 The precision and bias of each analytical method used should be determined in an appropriate matrix: that is, sediment, water, tissue. When appropriate, reagent blanks, recoveries, and standards should be included when samples are analyzed.

#### 15. Acceptability of Test

15.1 A sediment toxicity test should be considered unacceptable if one or more of the following occurred, except, for example, if temperature was measured numerous times, a

deviation of more than 3°C (see 13.6) in any one measurement might be inconsequential. However, if temperature was measured only a minimal number of times, one deviation of more than 3°C might indicate that more deviations would have been found if temperature had been measured more often.

15.1.1 All test chambers (and compartments) were not identical (see 8.4.1, 12.3),

15.1.2 The overlying water was not acceptable to the test organisms (see 9.1),

15.1.3 Test organisms were not acclimated to the appropriate overlying water or temperature (if they were cultured in water different from the overlying water or temperature),

15.1.4 The natural geochemical properties of test sediment collected from the field was not within the tolerance limits of the test species (see 10.3.5),

15.1.5 Appropriate negative and solvent controls, or reference sediment, were not included in the test (see 10.4.3),

15.1.6 The concentration of solvent in the range used affected survival, growth, or reproduction of the test organisms (see 10.4.4),

15.1.7 All animals in the test population were not obtained from the same source, were not all of the same species, or were not of acceptable quality (see 11.3),

15.1.8 Treatments were not randomly assigned to individual test chamber locations and the individual test organisms were not impartially or randomly assigned to test chambers or compartments (see 12.3),

15.1.9 Each test chamber did not contain the same amount of sediment, determined either by volume or by weight,

15.1.10 Temperature, dissolved oxygen, and concentration of test material were not measured, or were not within the acceptable range (see 13.7 and Annexes A1 through A4),

15.1.11 The negative control or reference sediment organisms did not survive, grow or reproduce as required for the test species (see Annexes A1 through A4), or

15.1.12 Average survival in any negative control chamber was less than acceptable limits (see Annexes A1 through A4).

#### 16. Calculation

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16.1 The calculation procedure(s) and interpretation of the results should be appropriate to the experimental design. Procedures used to calculate results of toxicity tests can be divided into two categories: those that test hypotheses and those that provide point estimates. No procedure should be used without careful consideration of the advantages and disadvantages of various alternative procedures, and appropriate preliminary tests, such as those for outliers and for heterogeneity.

16.2 For each set of data, the LC50 or EC50 and its 95 % confidence limits should be calculated (when appropriate) on the basis of (a) the measured initial concentrations of test material, if available, or the calculated initial concentrations for static tests, and (b) the average measured concentrations of test material, if available, or the calculated average concentrations for flow-through tests. If other LC or ECs are calculated, their 95 % confidence limits should also be calculated (see Guide E 729).

16.3 Most toxicity tests produce quantal data, that is, counts of the number of responses in two mutually exclusive

categories, such as alive or dead. A variety of methods (32) can be used to calculate an LC50 or EC50 and 95% confidence limits from a set of quantal data that is binomially distributed and contains two or more concentrations at which the percent dead or effected is between zero and 100, but the most widely used are the probit, moving average, Spearman-Karber and Litchfield-Wilcoxon methods. The method used should appropriately take into account the number of test organisms per chamber. The binomial test can also be used to obtain statistically sound information about the LC50 or EC50 even when less than two concentrations kill or affect between zero and 100 percent. The binomial test provides a range within which the LC50 or EC50 should lie.

16.4 When samples from field sites are independently replicated, the sites effects can be statistically compared by t-tests, analysis of variance (ANOVA) or regression type analysis. Analysis of variance is used to determine whether any of the observed differences among the concentrations (or samples) are statistically significant. This is a test of the null hypothesis that no differences exist in the effects at all of the concentrations (or samples) and at the control. If the F-test is not statistically significant (P > 0.05), it can be concluded that the effects observed in the test material treatments (or field sites) were not large enough to be detected as statistically significant by the experimental design and hypothesis test used. Nonrejection does not mean that the null hypothesis is true. The NOEC based on this end point is then taken to be the highest test concentration tested (33, 34). The amount of effect that occurred at this concentration should be considered.

16.4.1 All exposure concentration effects (or field sites) can be compared with the control effects by using mean separation techniques such as those explained by Chew (35) orthagonal contrasts, Fisher's methods, Dunnett's procedure or Williams' method. The lowest concentration for which the difference in observed effect exceeds the statistical significant difference is defined as the LOEC for that end point. The highest concentration for which the difference in effect is not greater than the statistical significant difference is defined as the NOEC for that end point (33).

#### 17. Report

17.1 The record of the results of an acceptable sediment toxicity test should include the following information either directly or by reference to available documents:

17.1.1 Name of test and investigator(s), name and location of laboratory, and dates of start and end of test,

17.1.2 Source of negative control, reference or test sediment, method for collection, handling, shipping, storage and disposal of sediment,

17.1.3 Source of test material, lot number if applicable, composition (identities and concentrations of major ingredients and impurities if known), known chemical and physical properties, and the identity and concentration(s) of any solvent used,

17.1.4 Source of overlying water, its chemical characteristics, and a description of any pretreatment, and results of any demonstration of the ability of a species to survive, grow or reproduce in the water,

17.1.5 Source, history and age of test organisms; source,

history and age of brood stock, culture procedures; and source and date of collection of the test organisms, scientific name, name of person who identified the organisms and the taxonomic key used, age, life-stage, means and ranges of weight and lengths, observed diseases or unusual appearance, treatments, holding and acclimation procedures,

17.1.6 Source and composition of food, concentrations of test material and other contaminants, procedure used to prepare food, feeding methods, frequency and ration,

17.1.7 Description of the experimental design and test chambers (and compartments), the depth and volume of sediment and overlying water in the chambers, lighting, number of test chambers and number of test organisms per treatment, date and time test starts and ends, temperature measurements, dissolved oxygen concentration (as percent saturation) and any aeration used prior to initiating a test and during the conduct of a test,

17.1.8 Methods used for, and results of (with standard deviations or confidence limits), physical and chemical analyses of sediment,

17.1.9 Definition(s) of the effects used to calculate LC50 or EC50s, biological endpoints for tests, and a summary of

general observations of other effects,

17.1.10 A table of the biological data for each test chamber for each treatment including the control(s) in sufficient detail to allow independent statistical analysis,

17.1.11 Methods used for, and results of, statistical anal-

yses of data,

17.1.12 Summary of general observations on other effects or symptoms, and

17.1.13 Anything unusual about the test, any deviation from these procedures, and any other relevant information.

17.2 Published reports should contain enough information to clearly identify the methodology used and the quality of the results.

#### **ANNEXES**

(Mandatory Information)

#### A1. HYALELLA AZTECA

A1.1 Significance—Hyalella azteca (Saussure), Amphipoda, has many desirable characteristics of a test species: short generation time, easily collected from natural sources or cultured in the laboratory in large numbers, and data on survival, growth, and reproduction can be obtained in toxicity tests (36). Landrum and Scavia (37), Nebeker et al. (22), and Ingersoll and Nelson (4) have successfully used H. azteca in sediment toxicity testing and have shown it to be a sensitive indicator of the presence of contaminants associated with sediments. Ingersoll and Nelson (4) report H. azteca to have a wide tolerance of sediment grain size. Sediment ranging from >90 % silt- and clay-size particles to 100 % sand-size particles did not reduce survival or growth in the laboratory.

A1.2 Life History and Life-Cycle—The life-cycle of H. azteca can be divided into three distinct stages according to Cooper (36): (1) an immature stage, consisting of the first 5 instars; (2) a juvenile stage, including instars 6 and 7; and (3) an adult stage, the 8th instar and older. The potential number of adult instars is large and growth is indeterminate such that old adults can be much larger than younger adults (38). DeMarch (39) indicates that juvenile H. azteca can complete a life-cycle in 27 days or longer depending on temperature.

A1.2.1 H. azteca is an epibenthic detritivore and will burrow in the sediment surface, and Hargrave (40) has demonstrated in laboratory experiments that H. azteca digests bacteria and algae from ingested sediment particles (<65 µm), further illustrating sediment interactions by H. azteca.

A1.2.2 Sexual dimorphism occurs in H. azteca; the adult male is larger than females and has larger second gnathopods (41).

A1.2.3 DeMarch (41) indicates that the number of young

produced per adult female is optimum at temperatures of between 26 and 28°C. Whereas, Cooper (36) and Strong (38) report that maximum brood size is more dependent on the size of the adult amphipods than on temperature.

A1.3 Obtaining Test Organisms—The following culture procedures are adapted from deMarch (41), Nebeker et al. (22), and Ingersoll and Nelson (4). H. azteca can be reared in 10- or 20-L aquaria under flowing water conditions with a 16 to 8 h ratio of light to darkness photoperiod at  $20 \pm 2^{\circ}$ C, and about 500 fc (5382 lx). For static cultures, the water should be gently aerated and about 25 to 30 % of the water volume should be replaced weekly. In flow-through cultures, water delivery can be at a low rate (100 mL/min) (4).

A1.3.1 H. azteca can be cultured with a variety of foods. Dried maple, alder, birch or poplar leaves, presoaked for several days and tannins flushed out with water, then can be added weekly as the primary substrate and food. Rabbit pellets, ground cereal leaves, fish food flakes, frozen or newly hatched brine shrimp, or heat-killed young Daphnia can be used to feed H. azteca. In addition, Strong (38) demonstrated success in culturing H. azteca yielding the best survivorship and consistently the largest clutches by feeding the amphipods filamentous green algae (Oedogonium cardiacum) and homogenized rotting spinach ad libitum.

A1.3.2 To clean the culture tanks or reduce populations of animals, half of the leaf substrate containing a portion of the animals should be transferred to a sorting tray, discarding

Rabbit pellets, such as Purina Rabbit Pellets, available from Purina Mills, Inc., 1401 Hanley St., St. Louis, MO 63144, have been found suitable for this purpose.

¹⁰ Ground cereal leaves, such as Cerophyl, available from Sigma Chemical Co., P.O. Box 14508, St. Louis, MO 63178, has been found suitable for this purpose.

11 Fish food flakes such as Tetra-Min and Tetro Conditioning Food, available from many pet foot distributors, have been found suitable for this purpose.

the remainder of the old contents and returning the leaf substrate and animals to the chamber. The number of amphipods should be reduced periodically as the population

expands rapidly.

Al.4 Collection—H. azteca can be found in permanent lakes, ponds and streams throughout the entire American continent (41, 42). Methods used by Landrum and Scavia (37) indicate that the amphipods can be collected from a natural freshwater source. Pennak (42) suggests using a dip-net to collect aquatic vegetation and bottom debris containing amphipods. Sites with stony bottoms might require collecting with forceps or the use of a small aquarium net. Live specimens can be maintained in aquaria if they are well supplied with aquatic vegetation (42). Collection procedures for H. azteca by deMarch (41) indicate that rinsing aquatic vegetation is effective if a 200 to 550 µm mesh net is used to catch the amphipods. Up to 200 amphipods can be transported in a large plastic bag containing 1 L of water from the collection site, with the remainder of the bag filled with air or oxygen and then placed into a cooler (41). For verification and accurate identification of field collected H. azteca, it is important that mature males and females be used (42).

A1.5 Brood Stock—Brood stock can be obtained from the wild, another laboratory or a commercial source. H. azteca brought into the laboratory should be acclimated to the culture water by gradually changing the water in the culture chamber from the water in which they were transported to 100 % culture water. H. azteca should be acclimated to the culture temperature by changing the water temperature at a rate not to exceed 2°C within 24 h, until the desired temperature is reached (41). Brood stock should be cultured so they are not unnecessarily stressed. To maintain H. azteca in good condition and avoid unnecessary stress, crowding and rapid changes in temperature and water quality characteristics should be avoided.

A1.6 Handling—H. azteca should be handled as little as possible. When handling is necessary, it should be done as gently, carefully, and quickly as possible, so that the amphipods are not unnecessarily stressed. Amphipods should be introduced into solutions beneath the air-water interface (4). Any H. azteca that touch dry surfaces, are dropped, or injured during handling should be discarded. Removing animals from sieves may form air bubbles on body surfaces causing animals to float on the water surface. Any "floaters" should be gently placed into the water column using a probe. If the animals continue to float they should be removed and discarded.

A1.7 Age—Tests with H. azteca should be started with juvenile organisms (second or third instar) about 2 to 3 mm in length (4, 22). To obtain H. azteca for testing, amphipods should be separated from the leaf material by scooping up the leaves with clinging amphipods, and placing the leaves on a 5 to 10 mm mesh screen, which is placed over a collecting pan containing 2 cm of culture water. Culture water should be sprinkled on the leaves while turning and separating the leaves. Mixed age H. azteca should be washed from the leaves and dropped through the screen into a collecting pan (22). To separate the juvenile amphipods from the larger adults a sieve stack (U.S. Standard) #30 (600  $\mu$ m), #40 (425  $\mu$ m), and a #60 (250  $\mu$ m) can be used (4). Culture water should be rinsed through the sieves and juvenile ani-

mals retained by the #60 sieve are washed into a collecting pan while the larger animals in the top sieves (#30 and #40) are returned to the culture. The juvenile amphipods are then placed in 1-L beakers containing culture water (about 200 amphipods/beaker) and kept in the dark at the temperature of the culture with gentle aeration. H. azteca can be isolated in the 1-L beakers up to 24 h prior to the start of the sediment toxicity test.

A1.7.1 Borgmann (43) recommends collecting uniform aged young (<1 week old) for experimental purposes using 2.5-L jars containing about 1 L of culture water and between 5 and 25 adult *H. azteca*. The jars are placed in an incubator at 16 to 8 h ratio of light to darkness photoperiod, about 500 fc (5382 lx). Each jar contains pieces of pre-soaked (in culture water) cotton gauze as a substrate. Once a week the animals should be removed from the gauze and collected by filtration through a 275 µm nylon mesh screen, then rinsed into petri dishes where the young and adults are sorted. Fresh culture water and food should be placed in the jars and the adults returned. Each jar should receive 0.02 g of fish food flakes¹⁰ or more if required by larger animals.

A1.8 Acclimation—If amphipods are cultured in water different from the overlying water or temperature, an acclimation process is necessary. The water acclimation process used by Ingersoll and Nelson (4) is to first place animals for 2 h in a 50 to 50 mixture of culture water to overlying water, then for 2 h in a 25 to 75 mixture of culture water to overlying water, followed by a transfer into 100 % overlying water. At this stage the amphipods are considered acclimated to the overlying water and are ready for immediate use. H. azteca can then be randomly selected from the acclimation water with a pipette and placed into counting beakers (for example, 30-mL) that can be floated in the test chambers before the amphipods are introduced into the exposure system (4).

A1.9 Toxicity Test Specifications:

A1.9.1 Experimental Design-Decisions concerning the various aspects of experimental design, such as the number of treatments, number of test chambers and amphipods per treatment, and water quality characteristics, should be based on the purpose of the test and the procedure used to calculate results. Nebeker et al. (22) recommend two or more replicate 20-L aquaria per treatment with 100 juvenile H. azteca placed in each aquarium. Ingersoll and Nelson (4) recommend four replicate 1-L beakers per treatment, with 20 H. azteca per replicate, for a total of 80 amphipods per treatment. Duration of the test can range from a ≤10 day short-term test to a long-term test >10 days and continuing up to 30 days (4, 22). The number of young and adult survival (4, 22), growth, and development (4) can be used as the biological endpoints. A test duration up to 30 days can add potential reproductive capacity as another biological endpoint, measuring effects on reproductive behavior, appearance of secondary sex characteristics, egg production, and number of young produced. Tests with H. azteca have been conducted at 20°C (4, 22) and from 21 to 25°C (37), photoperiod 16 to 8 h ratio of light to darkness, about 50 fc (538 lx) (4).

A1.9.2 Static and Flow-Through Tests—Ingersoll and Nelson (4) and Nebeker et al. (22) recommend using borosilicate glass 1-L beakers to expose the *H. azteca* to the test material. These exposure chambers contain about 800

mL overlying water and 200 mL (2 cm) test sediment, in both the static and flow-through water systems. For the static tests cover watch glasses may be used to fit over the top, such that an aeration tip fits through the beaker pour spout and the cover (4). Nebeker et al. (22) suggest for the static long-term test, using 20-L aquaria with 2 to 3 cm of test sediment on the bottom overlaid with 15 cm water. For flowthrough testing, Ingersoll and Nelson (4) suggest using a 4 by 13 cm notch cut in the lip of the 1-L beaker. The notch should be covered with 0.33 mm U.S. Standard sieve size #50 screen, either made of stainless steel or polyethylene, using a silicone adhesive to attach the screen to the beaker.

A1.9.3 Initiation of a Test—Sediments should be homogenized and placed in the test chambers on the day prior to the addition of the test organisms (Day -1). Test chambers should be covered and overlying water aerated (4) or unaerated overnight but aerated for 30 min before H. azteca are added (22). The test begins when the juvenile H. azteca are introduced to the test chambers (Day 0). It is recommended that flow-through and static tests might need to be started on different days to assure that sufficient time is available to complete all tasks. Test chambers should be inspected <2 hours after amphipods are introduced to ensure that animals are not trapped in the surface tension of the water (4). These floaters might not survive well and should be replaced with new animals (see A1.6).

A1.9.4 Feeding—Ingersoll and Nelson (4) recommend rabbit pellets⁹ to be used as a food for *H. azteca* in short and long-term sediment toxicity tests. Nebeker et al. (22) suggest feeding rabbit pellets⁹ in a 28 day test. The pellets should be ground and dispersed in deionized water. A fluorocarbon plastic stir bar and a magnetic stir plate should be used to homogeneously resuspend the rabbit pellet⁹ when aliquots are removed for feeding. If food collects on the sediment, a fungal or bacterial growth might start on the surface of the sediment, in which case feeding should be suspended for one or more days. A drop in dissolved oxygen to 40 % saturation might indicate that all of the food added in the water is not being consumed such that feeding might be suspended for the amount of time necessary to increase the dissolved oxygen concentration (4).

Al.9.4.1 In static tests Nebeker et al. (22) suggest a feeding regime twice weekly of 200 mg (0.5 mL dry volume) rabbit pellets⁹ mixed in 100 mL distilled water for 100 juvenile *H. azteca* in a 20-L aquarium. Nelson and Ingersoll (4) recommend feeding *H. azteca* three times weekly 14 mg

rabbit pellets per feeding for 20 young amphipods in a 1-L beaker. Lower feeding levels for flow-through and static tests may be used for *H. azteca*: three times weekly 6 mg rabbit pellets⁹ per feeding for the first week of the test, and 12 mg per feeding for the following weeks.

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A1.9.4.2 For flow-through testing, prior to starting a test, 20 mg rabbit pellets⁹ should be added to each test chamber, and three times a week each test chamber should be fed 20 mg per feeding for 20 young *H. azteca* during the exposure (4).

A1.10 Biological Data—During the conduct of the test. observations should be made to assess behavior (for example, floaters, sediment avoidance) and reproductive activities (for example, amplexus). At the end of the test the H. azteca must be removed from the test chambers for survival (4, 22). observable behavior, any noticeable reproduction (for example, amplexus, gravid females, young present) and growth (4). According to Ingersoll and Nelson (4) without material above the sediment surface, such as the leaves used in culturing, H. azteca burrow in the top 1 cm sediment surface or are found swimming in the water column. Many of the surviving amphipods can be pipeted from the water column before sieving the sediments. At the end of the test the sediment should be screened using a #35 (500 µm) U.S. Standard size sieve (22). Ingersoll and Nelson (4) recommend using a #50 (300 µm) U.S. Standard size screen cup first by swirling the overlying water to suspend the upper 1 cm of sediment and pouring that slurry into the cup. Next, a stack of sieves #25 and #40 U.S. Standard size should be used to sieve the bulk sediment in order to collect and count the live animals remaining in the sediment. The H. azteca are rinsed from the screens into collecting pans and pipeted from the rinse water (4). It might be difficult to recover young H. azteca due to their small size. Material retained in the collecting pans may be preserved in a sugar formalin mixture for examination at a later date (4). The preserved material may be inspected using a low power binocular microscope to search for H. azteca missed the last day of the test.

A1.10.1 For quantifying growth, H. azteca body length (±0.01 mm) should be measured from the base of the first antenna to the tip of the third uropod along the curve of the dorsal surface (4). In addition, wet and dry weight measurements have been used to estimate growth for H. azteca (37).

A1.10.2 A *H. azteca* sediment toxicity test, independent of duration, is unacceptable if the average survival in any negative control chamber is less than 80 % (see Section 15, Acceptability of Test).

#### A2. CHIRONOMUS TENTANS

A2.1 Significance—Chironomus tentans Fabricius (Diptera: Chironomidae) has been used in sediment toxicity tests because it is a fairly large midge with a short generation time, is easily cultured in the laboratory, and the larvae have direct contact with the sediment by burrowing into sediment to build a case. C. tentans has been successfully used in sediment toxicity testing and is sensitive to many contaminants associated with sediments (22, 25, 44, 45, 46). The members of the genus are important in the diet of young and adult fish and surface feeding ducks (47).

A2.2 Life History and Life-Cycle—The classification of holometabolous insects, such as C. tentans, presents special difficulties because each life-stage often has different ecological requirements. Further detailed studies at the species level are needed to better understand the various physical, chemical, and biological factors that interact to produce a suitable environment for larval development (48). C. tentans has a holarctic distribution and is locally common in the mid-continental areas of North America (47, 49, 50). Sadler (51) describes the general biology of C. tentans. The larval stages

often inhabit eutrophic lakes and ponds. Qualitative obserations indicate larvae occur most frequently in fine sediment and detritus; however larvae reportedly inhabit sediments with particles ranging from <0.15 mm to 2.0 mm (52). Chironomid larvae usually penetrate a few centimeters into sediment. In both lotic and lentic habitats with soft bottoms, about 95 % of the chironomid larvae occur in the upper 10 cm of substrate, very few larvae are found below 40 on (48). Larvae are generally not found when hydrogen sulfide is greater than 0.3 mg/L (52). Larvae of C. tentans are found in the field at a temperature range between 0 and 35°C, pH range between 7 and 10, conductivity range between 100 and 4000 µS cm⁻¹, sediment organic carbon range between 2 and 15 %, and at dissolved oxygen concentrations as low as 1 mg/L (47, 52, 53). Sadler (51) reported that C. tentans will gat essentially any material of appropriate size.

A2.2.1 The biology of C. tentans facilitates laboratory culture since larvae are tolerant of a wide spectrum of conditions and adults mate even when confined (47). The life-cycle of C. tentans can be divided into three distinct stages: (1) a larval stage, consisting of the 4 instars; (2) a pupal stage; and (3) an adult stage. Midge egg masses hatch in 2 or 3 days after deposition in water at 19 to 22°C. Larval growth occurs in four instars of about one week each. Under optimal conditions larvae will pupate and emerge as adults after 24 to 28 days at 20°C. Adults emerge from pupal cases over a period lasting several days. Males are easily distinguished from females because males have large, plumose antennae and a much thinner abdomen with visible genitalia. Mating behavior has been described by Sadler (51) and

others (54). A2.3 Obtaining Test Organisms—The following is a description of culturing procedures adapted from Adams et al. (25), Nebeker et al. (22) and others (47, 54); these procedures should not be considered definitive, since procedures that work well in one laboratory sometimes work poorly in another laboratory: C. tentans can be reared in aquaria in static or flowing water with a 16 to 8 h light to darkness photoperiod at 20 to 23°C, at about 50 fc (538 lx). For static cultures the water should be gently aerated, and about 25 to 30 % of the water volume should be replaced weekly. Cultures should be maintained in an isolated area or room free of contamination and excessive disturbances. Adams et al. (25) recommends rearing midges in glass aquaria filled with water to a depth of 45 cm covered with nylon screen. The size of the aquaria may vary from a minimum of 3 L to a maximum of 19 L depending on the need for animals.

A2.3.1 Chironomus tentans require a substrate in which to construct a case. Shredded paper towels have been found to be well suited for this purpose. Strips cut from brown paper towels should be soaked overnight in acetone to remove impurities and are then rinsed in three changes of culture water until the acetone is removed. A kitchen blender should be used to shred the rinsed towels into a pulp. Care must be taken to avoid over blending and possibly shortening the wood fibers in the pulp. The pulp should be rinsed twice with culture water to remove extremely small fibers and refrigerated until needed. The paper toweling pulp should be placed into the water of a culture chamber to a depth of 3 cm. One gram of dry fish food flakes¹¹ should be mixed in 10 mL of culture water with a kitchen blender and

refrigerated. This suspension should be fed twice daily to the cultures for optimum growth. The amount given depends on the number and size of the larvae. If after feeding the culture water does not clear in 3 to 4 h, the feeding level should be reduced. Overfeeding will lead to the growth of fungus in the aquaria and will necessitate more frequent water changes. Therefore, new cultures should receive 0.5 mL or less of this suspension per feeding. Nebeker et al. (22) suggest supplementing the fish food flakes¹¹ diet with ground cereal leaves. ¹⁰

A2.4 Brood Stock—Brood stock can be obtained from the wild, laboratory or a commercial source. When midges are brought into the laboratory, they should be acclimated to the culture water by gradually changing the water in the culture chamber from the water in which they were transported to 100 % culture water. Midges should be acclimated to the test temperature by changing the water temperature at a rate not to exceed 2°C within 24 h, until the desired temperature is reached. Brood stock should be cultured so they are not unnecessarily stressed. To maintain midges in good health and avoid unnecessary stress, crowding and rapid changes in temperature and water quality characteristics should be avoided.

A2.5 Age—Tests with C. tentans can be started with second instar larvae according to Wentsel et al. (44), Adams et al. (25), Nebeker et al. (22) and Giesy (45). Tests started with first instar C. tentans larvae have met with limited success (22). Twelve to 16 days before a test is begun, at least 3 freshly laid midge egg cases should be placed in a clean 20 by 40 cm glass or enameled rearing pan filled with water to a depth of 3 cm. Egg cases should be isolated by aspirating adults into a 250-mL Erlenmeyer flask in the morning. In late afternoon, about 20 mL of culture water should be added to the flask. Egg cases are deposited overnight and first instar larvae begin to hatch after about 3 days at 20°C. No substrate is added to the pan before hatching. Fish food flakes11 should be added at a rate of 50 mg/day suspended in water. Fresh water should be added as needed to make up for evaporation. The larvae in the rearing pans are presumed to be second instars on the 12th day from the time the eggs were laid (10 day old larvae). Most larvae will remain as second instars through the 16th day (14 day old larvae). Larvae ≥16 days old should not be used to start a test. To maintain a supply of second instar larvae for active toxicity testing, a rearing pan should be started every 4 days. Each pan can be expected to produce at least enough second instar larvae for one sediment toxicity test.

A2.6 Handling—Midges should be handled as little as possible. When handling is necessary, it should be done as gently, carefully, and quickly, so that the midges are not unnecessarily stressed. Larvae should be transferred with a 7-mm inner diameter glass pipet. Midges should be introduced into solutions beneath the air-water interface. Any midges that touch dry surfaces, are dropped, or injured during handling should be discarded.

A2.7 Acclimation—If the midges are cultured in water different from the overlying water or temperature, an acclimation process is necessary. The water acclimation process used by Ingersoll and Nelson (4) is to first place animals for 2 h in a 50 to 50 ratio mixture of culture water to overlying water, then for 2 h in a 25 to 75 ratio mixture of culture

water to overlying water, followed by a transfer into 100 % overlying water. At this stage the midges are considered acclimated to the overlying water and are ready for immediate use. Midges should be randomly selected from the acclimation water with a pipette and placed into counting beakers, for example 30-mL, that can be floated in the test chambers before the midges are introduced into the exposure system (4).

A2.8 Toxicity Test Specifications:

A2.8.1 Experimental Design—Decisions concerning the various aspects of experimental design, such as the number of treatments, number of test chambers and midges per treatment, and water quality characteristics, should be based on the purpose of the test and the type of procedure that is to be used to calculate results. Tests with C. tentans have been conducted at temperatures between 20 and 23°C (22, 25, 44). Cooler test temperatures may reduce the growth of fungus on the sediment surface. Duration of the test can range from a ≤10 day test to >10 days and continuing up to 25 days (22, 25, 44, 45). Larval survival, growth, or adult emergence can be monitored as biological endpoints.

A2.8.2 Static and Flow-Through Tests—Wentsel et al. (44) recommend using 20 C. tentans in each 2-L exposure beaker containing 2 cm of sediment and 1.5 L of overlying water in static testing. Adams et al. (25) use 3-L aquaria constructed of glass and silicone rubber for either static or flow-through testing. These test chambers measure 20.5 by 12.5 by 14.5 cm with a 12.5 by 44.5 cm piece of fine mesh stainless steel screen positioned on the upper end of one side. This overflow screen prevents the escape of larvae and maintains an overlying water volume of 2 L with 100 g of test sediment and 25 C. tentans larvae per chamber. Nebeker et al. (22) recommend 20-L aquaria with 100 C. tentans larvae and 2 to 3 cm of test sediment on the bottom with 15 cm of overlying water in static tests. If less sediment is available for testing, 4-L glass jars can be used, but proportionally fewer animals and less food should be used. Adams et al. (25) and Giesy et al. (45) also describe a method to expose midges individually to contaminated sediment in static tests. Up to 15 C. tentans are placed in separate 50-mL plastic centrifuge tubes. Each tube contains one midge, 7.5 g of sediment and 47 mL of water. For 24 h after hatching, first instar midge larvae are often planktonic (55). If flowthrough tests are started with first instar C. tentans larvae, water flow into the test chambers should not be started for at least 24 h after larvae are added. This will allow time for larvae to settle onto the sediment surface.

A2.8.3 Initiation of a Test—Sediments should be homogenized and placed in the test chambers on the day before addition of test organisms (Day -1). Test chambers should be covered and overlying water aerated overnight. The test begins when midges are introduced to the test chambers (Day 0). Larvae must be collected from at least three separate egg cases to start a sediment toxicity test. It is recommended that flow-through and static tests might need to be started on different days to assure that sufficient time is available to complete all tasks. Test chambers should be inspected <2 hours after midges are introduced to ensure that animals are not trapped in the surface tension of the water (4). These floaters do not survive well and should be replaced with healthy animals.

A2.8.4 Feeding-Adams et al. (25) recommend feeding animals in flow-through or static tests 50 mg fish food flakes¹¹ (dry weight, administered in a 0.5 mL suspension) daily to each 3-L test chamber containing 25 larvae. Nebeker et al. (22) suggest feeding animals in static tests a food mixture of 600 mg ground cereal leaves 10 (1.5 mL dry volume) and 100 mg (0.3 mL dry volume) of finely crushed fish food flakes11 in water and feeding this amount of food to the 100 C. tentans larvae in each 20-L test chamber at the start of the test (Day 0) and on Day 8. On Day 14 they should be fed 800 mg (2.0 mL) ground cereal leaves¹⁰ and 100 mg (0.3 mL) fish food flakes,11 and on Day 18 they should be fed 1000 mg (2.5 mL) ground cereal leaves¹⁰ and 100 mg (0.3 mL) fish food flakes. 11 Giesy et al. (45) recommend feeding a 0.1 mL suspension of 0.06 g/mL goldfish food¹² daily to each individual midge in each centrifuge tube. If food collects on the sediment, a fungal or bacterial growth might start on the surface of the sediment. in which case feeding may be suspended for one or more days. A drop in dissolved oxygen to 40 % saturation might indicate that all of the food added in the water is not being consumed such that feeding should be suspended for the amount of time necessary to increase the dissolved oxygen concentration.

A2.8.5 Biological Data—Several endpoints can be monitored in midge sediment toxicity tests. During the test, emergence of larvae from the test sediment can be monitored. Additionally, data on larval survival, growth, and adult emergence can be obtained.

A2.8.5.1 Larval survival and growth can be assessed by ending the tests on Day 10 to Day 14 when larvae have reached the third or fourth instar (22, 25, 45). At this time, larvae can be removed from sediment using a #35 (500 µm) U.S. Standard size sieve (4). The midges can be rinsed from the sieve into collecting pans and pipeted from the rinse water. Growth determinations using dry weight (dried at 60°C to a constant weight) is preferable to length. Growth can also be estimated by measuring head capsule width, and also be used to determine instar development.

A2.8.5.2 Nebeker et al. (22) suggest conducting adult C. tentans emergence sediment toxicity tests for 25 days when tests are started with second instar larvae. The adult emergence exposure chambers are covered by screen to retain emerging adults. The adult C. tentans should begin emerging after 20 days; the test should be continued for at least 5 days to count all the adults emerging and monitor delayed development. A small vacuum pump with a 10-mm diameter plastic line running through an Erlenmeyer flask trap is used to collect adults and make daily count of adults emerging. The screen cover is slowly lifted off the container and the adults are vacuumed from the screen and inside walls of the container. Percent adult emergence is generally less than 60 % in these tests. Endpoints calculated in these adult emergence tests can include (1) percent emergence, (2) mean emergence time, or (3) day to first emergence. Egg hatching studies may also be conducted by covering the test chambers and confining the adults. Adults will emerge and

¹² Goldfish food, such as Tetra-Min, available from many pet food distributors, has been found suitable for this purpose.

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lay eggs in these chambers. These egg masses can then be used to estimate effects of exposure on either the number of eggs produced or hatched.

A2.8.5.3 A C. tentans sediment toxicity test, independent of test duration, is unacceptable if the average survival in any

negative control chamber is less than 70 % (see Section 15, Acceptability of Test).

Note A2.1—A low percent emergence of adults might not be the result of low survival; larvae or pupae might not have completed development.

#### A3. CHIRONOMUS RIPARIUS

A3.1 Significance—Chironomus riparius Meigen (Diptera: Chironomidae) has been used in sediment toxicity tests because it is a fairly large midge, has a short generation time, is easily cultured in the laboratory, and the larvae have direct contact with the sediment by burrowing into the sediment to build a case. C. riparius has been successfully used in sediment toxicity testing and is sensitive to many contaminants associated with sediments (4, 56, 57, 58). The members of the genus are important in the diet of young and adult fish and surface feeding ducks (47).

A3.2 Life History and Life-Cycle—The classification of holometabolous insects, such as C. riparius, presents special difficulties because each life-stage often has different ecological requirements. Further detailed studies at the species level are needed to better understand the various physical, chemical, and biological factors that interact to produce a suitable habitat for larval development (47). The distribution of the family is world wide. Most of the species in the family are thermophilous and adapted to living in standing water, although species do occur in cold habitats and in running water (47). C. riparius is a nonbiting midge. The tubiculous larvae frequently inhabit eutrophic lakes, ponds, and streams and reportedly live in mud-bottom littoral habitats to depths up to 1.0 m (59). Qualitative observations indicate larvae inhabit gravel, limestone, marl, plants, and silt (53). Ingersoll and Nelson (4) report C. riparius to have a wide tolerance of sediment grain size. Sediment ranging from >90 % silt- and clay-size particles to 100 % sand-size particles did not reduce larval survival or growth in the laboratory. Larvae of C. riparius larvae reportedly occur in the field at a temperature range between 0°C and 33°C, pH range between 5 and 9, and at dissolved oxygen concentrations as low as 1 mg/L (53). C. riparius tubes are of the type characteristic of bottom-feeding chironomid larvae (59). Larvae frequently extend their anterior ends outside of their tubes feeding on the sediment surface (59). Credland (60) reported C. riparius will eat a variety of materials of the appropriate size.

A3.2.1 The biology of C. riparius facilitates laboratory culture since larvae are tolerant of a wide spectrum of conditions and adults mate even when confined (55, 58, 60). The life-cycle of C. riparius can be divided into three distinct stages: (1) a larval stage, consisting of the 4 instars; (2) a pupal stage; and (3) an adult stage. Midge egg masses hatch in 2 or 3 days after deposition in water at between 19 and 22°C. Larval growth occurs in four instars of about 4 to 7 days each. Under optimal conditions larvae will pupate and emerge as adults after 15 to 21 days at 20°C. Adults emerge from pupal cases over a period lasting several days. Males are easily distinguished from females because males have large, plumose antennae and a much thinner abdomen with visible genitalia. Mating behavior has been described by Credland (60).

A3.3 Obtaining Test Organisms—The following is a description of culturing procedures adapted from Ingersoll and Nelson (4) and others (51, 54, 58, 60); these procedures should not be considered definitive, since procedures that work well in one laboratory sometimes work poorly in another laboratory: C. riparius can be reared in aquaria in either static or flowing water with a 16 to 8 hour ratio of light to darkness at 20 to 22°C, at about 50 fc (538 lx). For static cultures the water should be gently aerated and about 25 to 30 % of the water volume should be replaced weekly. Cultures should be maintained in an isolated area or room free of contamination and excessive disturbances. Ingersoll and Nelson (4) recommend rearing C. riparius in 30 by 30 by 30-cm polyethylene containers covered with nylon screen. Each culture chamber contains 3 L of culture water. At least three egg cases should be used to start a new culture. To start a culture, 200 to 300 mg of ground cereal leaves9 is added to the culture chamber; additionally, green algae (Selenastrum capricornutum (61) is added ad libitum to maintain a growth of algae in the water column and on the bottom of the culture chamber. Cultures should be fed about 3 mL of a suspension of commercial dog treats (62) daily. This suspens sion should be prepared by heating and melting 15 g of do treats in 150 mL of culture water. After refrigeration, the oily layer which forms on the surface should be removed. The rest should be used to feed the cultures. This suspension contains about 100 mg dry solid/mL. Overfeeding will lead to the growth of fungus in the aquaria and will necessitate more frequent water changes. To obtain egg cases and larvae, adults should be left in the culture chamber to mate and deposit eggs. Egg cases adhere to the side of the culture chamber and can be removed with a sharp blade. These egg masses can then be placed in individual 100 mL beakers containing 50 mL of culture water, hatching should start in about 3 days at 20°C. While removal of adults by aspiration into a 250 mL flask before mating works well with C. tentans (see Annex A2), this procedure has not been successful with C. riparius.

A3.4 Brood Stock—Brood stock can be obtained from the wild, another laboratory, or a commercial source. When midges are brought into the laboratory, they should be acclimated to the culture water by gradually changing the water in the culture chamber from the water in which they were transported to 100 % culture water. Midges should be acclimated to the test temperature by changing the water temperature at a rate not to exceed 2°C within 24 h, until the desired temperature is reached. Brood stock should be cultured so they are not unnecessarily stressed. To maintain midges in good health and avoid unnecessary stress, crowding and rapid changes in temperature and water qualicharacteristics should be avoided.

A3.5 Age—Tests with C. riparius can be started with

either larvae less than 24-h old (4) or with three day old larvae (56, 57). Freshly laid midge egg cases can be transferred from the culture into individual 100 mL beakers ntaining 50 mL of culture water. At 20°C larvae should begin to hatch within 3 days. Larvae must be collected from at least three separate egg cases to start a sediment toxicity test.

A3.6 Handling—Midges should be handled as little as possible. When handling is necessary, it should be done as gently, carefully, and quickly as possible, so that the midges are not unnecessarily stressed. First instar midges should be transferred with a 2 mm inner diameter glass pipet (eye dropper). Older larvae should be transferred with a 7 mm inner diameter glass pipet. Midges should be introduced into solutions beneath the air-water interface. Any midges that touch dry surfaces, are dropped, or injured during handling should be discarded.

A3.7 Acclimation—If the midges are cultured in water different from the overlying water or temperature, an acclimation process is necessary. The water acclimation process used by Ingersoll and Nelson (4) is to first place animals for 2 h in a 50 to 50 ratio mixture of culture water to overlying water, then for 2 h in a 25 to 75 ratio mixture of culture water to overlying water, followed by a transfer into 100 % overlying water. At this stage the midges are considered acclimated to the overlying water and should be ready for immediate use. Midges should be randomly selected from the acclimation water with a pipette and placed into counting beakers (for example, 30-mL) that can be floated in the test chambers before the midges are introduced into the topoure system.

A3.8 Toxicity Test Specifications:

A3.8.1 Experimental Design—Decisions concerning the various aspects of experimental design, such as the number of treatments, number of test chambers and midges per treatment, and water quality characteristics, should be based on the purpose of the test and the type of procedure that is to be used to calculate results. Ingersoll and Nelson (4) recommend using 50 C. riparius in each 1-L exposure beaker containing 200 mL of sediment and 800 mL of overlying water in either static or flow-through testing. Lee (57) recommends using 13-L glass aquaria containing 130 C. riparius larvae, 2 L of sediment and 11 L of overlying water in static tests. Tests with C. riparius have been conducted at temperatures between 20 and 22°C (4, 56, 57). Cooler test temperatures might reduce the growth of fungus on the sediment surface. Duration of the test can range from a  $\leq 10$ day test to >10 days and continuing up to 30 days (4, 56, 57). Larval survival, growth, or adult emergence can be monitored as biological endpoints.

A3.8.2 Static and Flow-Through Tests—Ingersoll and Nelson (4) recommend that borosilicate glass 1-L beakers can be used to expose the C. riparius to the test material, in either static or flow-through tests. For the static tests, cover watch glasses may be used, such that an aeration line fits through the beaker pour spout and the cover. For flow-through testing, Ingersoll and Nelson (4) suggest using a 4 by 13 cm notch cut in the lip of the 1-L beaker. The notch hould be covered with 0.33 mm U.S. Standard sieve size #50 screen, either made of stainless steel or polyethylene, using a silicone adhesive to attach the screen to the beaker.

For 24 h after hatching, first instar midge larvae are often planktonic (55). Pittinger et al. (56) suggest not running water through the diluter for at least 24 h after larvae are added to the test chambers. This will allow time for larvae to settle onto the sediment surface.

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A3.8.3 Initiation of a Test-Sediments are homogenized and placed in the test chambers the day before addition of test organisms (Day 1). Test chambers are then covered and overlying water is aerated overnight. The test begins when midges are introduced to the test chambers (Day 0). Ingersoll and Nelson (4) start sediment toxicity tests with 50 first instar C. riparius larvae per 1-L test chamber. Pittinger et al. (56) and Lee (57) suggest starting tests with 3 day old larvae (130 larvae per 13-L chamber (57)). It is recommended that flow-through and static tests might need to be started on different days to assure that sufficient time is available to complete all tasks. Test chambers should be inspected <2 hours after midges are introduced to ensure that animals are not trapped in the surface tension of the water. These floaters do not survive well and should be replaced with healthy animals.

A3.8.4 Feeding—Lee (57) recommends feeding animals in a static system 200 mg fish food flakes¹¹ every other day to each 13-L test chamber containing 130 larvae. Pittinger et al. (56) suggest feeding animals in a static renewal system trout food¹³ and dehydrated cereal (5 to 1 w/w) and commercial dog treats daily to each test chamber containing 20 larvae. In flow-through and static toxicity tests, Ingersoll and Nelson (4) feed 50 C. riparius larvae in each 1-L test chamber a combination of ground cereal leaves¹⁰ (suspended in water), a green algae (S. capricornutum) and commercial dog treats. In flow-through sediment toxicity tests, 75 mg of ground cereal leaves.  10  30 mg of dog treats and 6  $\times$  10 7  S. capricornutum algal cells should be added to each 1-L test chamber the day test starts (Day 0). From Day 1 to Day 6 of the test, 15 mg of ground cereal leaves¹⁰ should be added to each test chamber, from Day 1 to Day 12, 30 mg of dog treats should be added to each test chamber and from Day 13 to the end of the test, 15 mg of dog treats should be added to each test chamber,  $6 \times 10^7$  S. capricornutum algal cells should be added to each test chamber daily. In static sediment toxicity tests, 10 mg of ground cereal leaves, 10 10 mg of dog treats and  $3 \times 10^7$  S. capricornutum algal cells should be added to each 1-L test chamber on Day 0. From Day 1 to Day 6 of the test, 10 mg of ground cereal leaves¹⁰ and  $3 \times 10^7$  algal cells should be added to each 1-L test chamber; for the first two weeks of the test, 10 mg of dog treats should be added to each test chamber each Monday, Wednesday, and Friday and for the rest of the test 5 mg of dog treats should be added to each test chamber each Monday, Wednesday and Friday; from Day 7 until the end of the test  $3 \times 10^7$  algal cells should be added to each test chamber each Monday, Wednesday and Friday. Lower feeding levels for flow-through tests might be used for C. riparius daily:  $6 \times 10^7$  S. capricornutum algal cells, 10 mg dog treats, and 10 mg ground cereal leaves¹⁰ on Days 0 through 6. If food collects on the sediment, a fungal or

¹³ Trout food, such as Ralston Purina Trout Chow, available from Purina Mills, Inc., 1401 Hanley St., St. Louis, MO 63144, has been found suitable for this purpose."

bacterial growth might start on the surface of the sediment, in which case feeding should be suspended for one or more days. A drop in dissolved oxygen to 40 % saturation might indicate that all of the food added in the water is not being consumed such that feeding should be suspended for the amount of time necessary to increase the dissolved oxygen concentration (4).

A3.8.5 Biological Data—Several endpoints can be monitored in midge sediment toxicity tests. During the test, emergence of larvae from the test sediment can be monitored. Additionally, data on larval survival, growth, and

adult emergence can be obtained.

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A3.8.5.1 Larval survival and growth can be assessed by ending the tests on Day 10 to Day 14 when larvae have reached the third or fourth instar (4, 25, 45). At this time, larvae should be removed from sediment using a #35 (500 µm) U.S. Standard size sieve (4). The midges should be rinsed from the sieve into collecting pans and pipeted from the rinse water. Growth determination using dry weight (dried at 60°C to a constant weight) is preferable to length. Growth can also be estimated by measuring head capsule width, and also used to determine instar development.

A3.8.5.2 Ingersoll and Nelson (4), Pittinger et al. (56) and Lee (57) recommend conducting C. riparius sediment toxicity tests until the larvae pupate and emerge as adults. Cast pupal skins left by emerging adult C. riparius should be removed and recorded daily. These pupal skins remain on the water surface for over 24 h after the emergence of the adult. The test should be ended after the animals have been exposed for up to 30 days, when about 70 to 95 % of the control larvae should have completed metamorphosis into the adult form. Endpoints calculated in these adult emergence tests can include: (1) percent emergence, (2) mean emergence time, or (3) day to first emergence. Egg hatching studies may also be conducted by covering the test chambers and confining the adults. Adults will emerge and lay eggs in these chambers. These egg masses can then be used to estimate effects of exposure on either the number of eggs produced or hatched.

A3.8.5.3 A C. riparius sediment toxicity test, independent of duration, is unacceptable if the average survival in any negative control chamber is less than 70 % (see Section 15,

Acceptability of Test).

NOTE A3.1—A low percent adult emergence might not be the result of low survival; larvae or pupae might not have completed development.

# A4. DAPHNIA SP. AND CERIODAPHNIA SP.

A4.1 Significance—Daphnia magna and Ceriodaphnia dubia are easily cultured in the laboratory, have a short generation time, and survival and reproduction data can be obtained in toxicity tests, and a large data base has developed regarding their sensitivity to toxicants. Nebeker et al. (22), Prater and Anderson (63), Giesy et al. (64), Malueg et al. (65), and Burton et al. (66) and others (45, 67-75) have successfully used cladocerans in sediment testing and have shown them to be sensitive indicators of the presence of associated contaminants.

A4.1.1 In whole sediment toxicity tests, cladocera behave as nonselective epifaunal zooplankton. The organisms are frequently observed on the sediment surface and are likely exposed to both water soluble and particulate bound contaminants (through ingestion) in overlying water and surface sediments. These routes of exposure do not, however, mimic those of infaunal benthic invertebrates, which are exposed directly to sediment and interstitial water. One of the most important reasons for using cladocerans as toxicity test organisms is their importance in the food web of some systems (42, 76, 77). These assays have been useful at discriminating sediment contamination and allowing comparisons of relative sediment toxicity. Because they are not benthic organisms, their responses may not be indicative of in situ benthic community effects.

A4.2 Life History and Life Cycle—Pennak (78) recognizes four distinct periods in the life history of a cladoceran: egg, juvenile, adolescent, and adult. Unstressed populations consist almost exclusively of females producing diploid parthenogenetic eggs which develop into female young. Adult Ceriodaphnia can produce from four to 15 parthenogenetic eggs in each brood whereas Daphnia can produce five to 25 or more eggs (79). When a clutch of eggs is released into the brood chamber, segmentation begins promptly; the

first juvenile instar is released into the surrounding water in approximately two days (78). There are only a few juvenile instars and the greatest growth occurs during these stages. The adolescent period is a single instar between the last juvenile instar and the first adult instar during which the first clutch of eggs reaches full development in the ovary. At the close of the adolescent instar, the animal molts and the first clutch of eggs is released into the brood chamber, while a second clutch is developing in the ovary. At the close of each adult instar, four successive events occur: the young are released from the brood chamber to the outside environment, molting occurs, with an increase in size, and there is release of a new clutch of eggs into the brood chamber.

A4.2.1 When populations are stressed (for example, low oxygen, crowding, starvation), males are produced from diploid parthenogenetic eggs. With the appearance of males, females produce haploid eggs which require fertilization. Following fertilization, the eggs are enclosed by the ephippium and shed at the next molt. The embryos lie dormant until suitable conditions arise upon which they become females producing diploid parthenogenetic eggs (80).

A4.3 Obtaining Test Organisms—The following culture procedures are adapted from Knight and Waller (81), while other appropriate methods include the U.S. Environmental Protection Agency (82, 83) and Guides E 729 and E 1295. Following Knight and Waller's (81) methodology, D. magna and C. dubia can be cultured in reconstituted hard water (160 to 180 mg/L  $CaCO_3$ ) and fed a daily diet of a vitamin enriched Selenastrum capricornutum suspension. Cultures are maintained at  $25 \pm 1^{\circ}C$  with a light:dark cycle of 16:8 h provided by overhead fluorescent lighting covered with opaque plastic to reduce light intensity to less than 20 lux This reduces the photosynthetic activity of the algal food, which could alter water quality. D. magna mass cultures are

started by placing 10 neonates (less than 24-h old) into 1-L beakers containing 500 mL reconstituted hard water and a feeding suspension of S. capricornutum of approximately 240 000 algal cells/mL culture water. Cultures are fed 12 mL initially and on Day 1, 25 mL (500 000 cells/mL culture water) on Days 2 through 4, and 25 to 50 mL (100 000 cells/ml culture water) on Day 5 and thereafter. Using this culture method, D. magna typically will have first broods between Days 6 and 8 with successive broods hatching every 36 to 48 h thereafter. On days when hatches occur and young are not needed, adults are transferred to clean 1-L beakers containing 300 mL hard water, 200 mL old culture water, and 50 mL of food. When neonates are needed for testing, adults are isolated the night before by placing each adult into a separate 100-mL beaker containing 100 mL reconstituted hard water and 3 mL feeding suspension. See also Specification E 1193 for culture requirements. Neither first brood young nor young from females older than two weeks are used in toxicity testing or initiating new cultures. The S. capricornulum feeding suspension may also be supplemented with an approximate 6 % by volume addition of ground cereal leaves¹⁰ preparation to the algal feeding suspension (Waller, personal communication). C. dubia mass cultures can be initiated by placing 20 neonates (less than 12 h old) into a 600 mL-beaker containing 360 mL reconstituted hard water and 12 mL of S. capricornutum feeding suspension. Cultures are fed 12 mL initially and on days one and two, and then 18 mL thereafter. When three distinct sizes are noted (generally day six), the largest organisms are isolated in 100 mL-beakers containing 60 mL of hard water and 2 mL feeding suspension. Third brood neonates, less than 12 h old are used in toxicity testing and initiating new mass cultures. Generally, the first brood is produced on day four, the second brood on day five and the third brood on day seven. See also Guide E 1295 for culture requirements.

A4.3.1 The U.S. Environmental Protection Agency (83) recommends culturing *D. magna* in reconstituted hard water at 20°C with ambient light intensity of 50 to 100 ft c (10 to 20 µE/m²/s, or 538 to 1076 lux), and a light:dark cycle of 16:8 h. Culture vessels can be 3-L glass beakers containing 2.75 L reconstituted hard water and 30 *D. magna*. The *D. magna* can be fed on a daily diet of *S. capricornutum* (100 000 algal cells/mL culture water) or fed three times a week a feeding suspension consisting of trout chow, alfalfa, and yeast (TCY) (1.5 mL TCY/1000 mL culture water). This should supply approximately 300 young per week.

A4.3.2 The U.S. Environmental Protection Agency (82) procedures for Ceriodaphnia cultures are as follows. Ceriodaphnia are cultured in moderately hard water (80 to 90 mg/L CaCO₃) at 25 ± 1°C and receive a light:dark cycle of 16:8 h. Mass cultures are maintained as backup organism reservoirs and individual organisms are cultured as the source of neonates for toxicity tests. Mass cultures can be initiated in two 3-L beakers filled to three-fourths capacity with moderately hard water and 40 to 50 neonates/L of medium. The stocked organisms should be transferred to fresh culture media twice weekly for two weeks. At each renewal, the adults are counted and the offspring and old medium discarded. The adults are discarded after two weeks and new mass cultures initiated with neonates. Mass cultures are fed daily at the rate of 7 mL of a yeast, ground cereal

leaves, 10 trout chow food preparation (YCT), and 7 mL of S. capricornutum concentrate (3.0 to 3.5  $\times$  10⁷ cells/mL). Individual C. dubia cultures are maintained in 30-mL plastic cups or beakers containing 15 mL of culture media. Cultures are fed daily at the rate of 0.1 mL YCT and 0.1 mL algal concentrate per 15 mL media and are transferred to fresh media at least three times a week. Adults are used as sources of neonates until 14 days of age. Cultures properly maintained should produce at least 15 young per adult in three broods (seven days or less). Goulden and Henry (79) list two other fresh water algal species which can be used for cladoceran food: Ankistrodesmus falcatus and Chlamydomonas reinhardtii. Winner (84) discusses the effects of four diets (C. reinhardtii, Selenastrum capricornutum, yeast, ground cereal leaves, 10 trout chow (YCT), and YCT plus S. capricornutum) and two reconstituted waters on the vitality of five to six lifespan generations of C. dubia. His results indicate that healthy populations can be maintained in reconstituted hard water containing only four salts as long as the food is nutritionally adequate and the water is reconstituted from an ultrapure base water.

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A4.4 Brood Stock—D. magna and C. dubia.¹⁴ Animals received from an outside source should be acclimated gradually to new culture media over a period of one to two days and taxonomy verified.

A4.5 Background—Experimental design, such as number of test chambers, number of treatments, animals per treatment, and water quality characteristics, should be based on the purpose of the test and the procedure used to calculate results. See Guides E 729 and E 1295, Test Method E 1297, and the preceding guide text for guidance. Nebeker et al. (87) recommended conducting 48 h sediment static tests in duplicate using 1-L beakers containing 200 mL of sediment and 800 mL of water (1:4). The sediment is allowed to settle overnight, followed by gentle aeration of overlying water for 30 min before introducing 15 D. magna per replicate. Malueg et al. (65) conducted recirculating sediment toxicity tests in a modified recycling device described by Prater and Anderson (63). The test chamber (23 cm long by 6.4 cm wide by 16 cm high) was positioned on a plexiglass plate over two 4-L jars. Twenty D. magna were placed in a vessel in the water column and five Hexagenia added to chamber sediment. Three to six replicates were used for each control and test sediment. Seven day (three brood) toxicity tests for aqueous media using cladocerans have been conducted (22, 86, 87) and variations of these methods used to assess sediment toxicity (22, 88).

A4.6 Handling—The cladocerans are delicate and should be handled as carefully and little as possible. They are transferred with a 5-mm bore pipet and released slowly beneath the water surface.

A4.7 Experimental Design for Acute Toxicity Tests—Sediments may be mixed, if appropriate for the study, by mixing with either a large plastic paddle, magnetic stirring bar or shaker table, before allocating to test chambers. See Test Method E 1297 and Guide E 1391 for guidance. Whole sediment assays use a 1:4 of sediment to water. Acute

¹⁴ Starter cultures obtained from the Aquatic Biology Branch, Environmental Monitoring Systems Laboratory, USEPA, 3411 Church Street, Newtown, OH 45244 have been found suitable.

toxicity tests are conducted in triplicate using 250 or 100-mL beakers to which 30 mL of sediment (by weight) and 120 mL of reconstituted or site water are added (for 250-mL beakers). The weight of 30 mL of sediment is determined by initially calculating the average wet weight (g) of five, 5-mL aliquots of sediment obtained using a 10-cc syringe. The average weight of 5-mL is divided by five to obtain the weight of 1 mL of sediment. The weight of 1 mL is multiplied by 30 mL to obtain the number of grams to be weighed into each test beaker. When a syringe cannot be used to dispense sediments, sediment weight is used rather than volume, weighing 30 g (wet weight) into each test beaker. In addition, sediment dry weights are determined by weighing triplicate three 5-mL aliquots of wet sediment, drying at 100 to 105°C for 24 h and then reweighing the sediment. Percent dry weight is calculated by dividing the dry sediment weight (g) by the wet weight and multiplying by 100. Grams of dry weight per mL of wet sediment is determined by dividing the dry weight by the mL of wet sediment. Overlying water is gently added to each beaker, minimizing sediment resuspension. After a 1 to 2 h settling period, ten test organisms are randomly added to each beaker. Test chambers should be inspected less than 2 h after the addition of test organisms to check for any floaters. Floaters may not survive and are subjected to a different exposure, thus can be removed and replaced within the first 2 h. Floating may be caused by the sediment sample and may be considered a treatment effect in some cases. However, responses tend to be variable and are seldom dose proportional. Surface films which entrap D. magna can be reduced by wiping the surface with cellulose filter paper prior to organism addition.

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A4.8 Experimental Design for Short-term Chronic Toxicity Tests—Test initiation, test conditions and monitoring are as described in A4.7, A4.9, and A4.9.1 with the following exceptions, and basically follow standard methods (22 and Guide E 1295). Tests are conducted in 30-mL beakers using 5 mL (or 5 g) sediment and 20 mL overlying water in replicates of ten. One organism (D. magna less than 24 h old

or *C. dubia* less than 6 h old) is randomly added to each beaker, after the settling period. At each 24-h test interval, the adult is removed and placed in a beaker containing the control water, young are counted and discarded, and physicochemical measures made. Approximately 15 mL of overlying water is suctioned off and gently renewed. The culturing food (such as YCT or algal-ground cereal leaves mixture) is then added (0.1 mL) to each beaker. After feeding, the adult organism is returned to the test beaker. The test is terminated at seven days and/or when at least 60 % of the controls have produced their third brood.

A4.9 Monitoring Data—Test conditions and monitoring should follow standard methods (82, 83). Test beakers are maintained at 25 ± 1°C and receive a 16:8 h light:dark cycle (20 lux). Dissolved oxygen and temperature are monitored at 0, 24, and 48 h. Dissolved oxygen should not be allowed to drop below 40 % saturation. If it does, gentle bubbling should be used until adequate saturation is attained. The pH, hardness, and alkalinity are monitored at 0 and 48 h. Survival numbers were recorded at 24 and 48 h. Death of a test animal is judged as a result of observing no movement upon gentle prodding. Tests are considered valid when control mortality is ≤ 10 % (83). Control treatments consist of reconstituted water or reference site water, and a control or reference sediment, or both, with the overlying test water (reconstituted or reference site). See the preceding guide text for additional guidance on sediment characterization, controls, references, and data analyses.

A4.9.1 The seven-day, three-brood survival and reproduction test requires the daily counting of adult survivors and young production. Dissolved oxygen, temperature, and pH should be measured daily, before renewing overlying waters on two to three beakers in each treatment and control. Alkalinity and hardness are measured at test initiation and termination. For the test results to be acceptable controls must have 80 % survival with C. dubia controls averaging 15 young and D. magna averaging 20 young per surviving female (82, 86, 89).

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# ATTACHMENT II

#### **MEMORANDUM**

TO: Monsanto Chemical Company

November 7, 1995

FR: Heidi Gregerson, Golder Associates Inc.

RE: DATA VALIDATION SUMMARY (913-1101.603)

#### INTRODUCTION

This memo presents the results of data validation on the data package prepared by Analytical Resources Incorporated. Sample information is provided in the following table.

SAMPLE ID	COMMENTS	ANALYSIS	MEDIA
SEE ATTACHMENT 3 FOR SAMPLE LIST		INORGANICS AND CHEMISTRY	70 SEDIMENT 3 WATERS

Attachments 1 through 3 provide the following information as indicated below:

Attachment 1. Glossary of Data Reporting Qualifiers

Attachment 2. Annotated Laboratory Reports

Attachment 3. Data Validation Supporting Documentation

## **DATA QUALITY OBJECTIVES**

This section presents a summary of the data quality in terms of the referenced validation criteria.

Precision. Goals for precision were met.

Accuracy. Goals for accuracy were met, with the exception of those deficiencies listed below.

Completeness. The data package was complete for all requested analyses. A total of 73 samples were validated in this data package with a total of 803 determinations reported, all of which were deemed valid.

Holding Time. No minor deficiencies were identified based on analytical holding times requiring qualification of data.

**Detection Limits.** Detection limits goals were met for all sample results.

Major Deficiencies. No major deficiencies were identified which required the qualification of data as unusable.

Minor Deficiencies. The following minor deficiencies were identified which required the qualification of data:

### Analytical Spike

• The analytical spike percent recovery for silver for samples M94SC034, M94SC036, M94SC040, M94SC046, M94SC049, and, M94SC059 were outside the control limit and qualification was applied accordingly. Attachments 2 and 3 provide the data qualified and supporting documentation.

## Field QC

- Samples M94SC009, M94SC031, and M94SC060 were identified as splits samples of M94SC006, M94SC030, and M94SC059, respectively. Attachment 3 provides a summary of the evaluated RPDs, however, qualification is not required for field QC.
- Samples M94SC022, M94SC035, and M94SC053 were identified as field duplicates of samples M94SC023, M94SC036, and M94SC054, respectively. The RPDs were evaluated and determined to be acceptable.

# ATTACHMENT 1 GLOSSARY OF DATA QUALIFIERS

## Glossary of Inorganic Data Reporting Qualifiers.

- B Indicates the constituent was analyzed for and detected. The concentration reported is less than the contract required detection limit (CRDL) but greater than the instrument detection limit (IDL). The associated data should be considered usable for decision making purposes.
- U Indicates the constituent was analyzed for and not detected. The concentration reported is the sample detection limit corrected for aliquot size, dilution and percent solids (in the case of solid matrices) by the laboratory. The associated data should be considered usable for decision making purposes.
- UJ Indicates the constituent was analyzed for and not detected. Due to a minor quality control deficiency identified during data validation the concentration may not accurately reflect the sample detection limit. The associated data have been qualified as estimated but should be considered usable for decision making purposes.
- BJ Indicates the constituent was analyzed for and detected at a concentration less than the contract required detection limit (CRDL) but greater than the instrument detection limit (IDL). Due to a minor quality control deficiency identified during data validation the associated data have been qualified as estimated, but should be considered usable for decision making purposes.
- J Indicates the constituent was analyzed for and detected. Due to a minor quality control deficiency identified during data validation the associated data have been qualified as estimated, but should be considered usable for decision making purposes.
- UR Indicates the constituent was analyzed for and not detected. Due to a major quality control deficiency identified during data validation, the associated data have been qualified as unusable for decision making purposes.
- R Indicates the constituent was analyzed for and detected. Due to a major quality control deficiency identified during data validation, the associated data have been qualified as unusable for decision making purposes.

# ATTACHMENT 2 ANNOTATED LABORATORY REPORTS



Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

ID number: M94SC001 Project: 913-1101.604

Description:

Sampled: 11/11/94 Received: 11/21/94

Matrix: Soil % Solids: 35.27

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: A

Released by:

## ANALYTICAL RI

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CAS Number	Analyte	Concentration	С	rod	Prep	М	Analyzed
7440-38-2	Arsenic	21 mg/kg-dry		1	SWN	GFA	12/02/94
7440-43-9	Cadmium	32.7 mg/kg-dry		0.9	SWC	ICP	12/06/94
7440-50-8	Copper	7.6 mg/kg-dry		0.9	SWC	ICP	12/06/94
7439-98-7	Molybdenum	2 mg/kg-dry	Ū	2	SWC	ICP	12/06/94
7440-02-0	Nickel	35 mg/kg-dry		4	SWC	ICP	12/06/94
7782-49-2	Selenium	5 mg/kg-dry		1	SWN	GFA	12/01/94
7440-22-4	Silver	0.24 mg/kg-dry		0.04	SWN	GFA	12/07/94
7440-62-2	Vanadium	38.0 mg/kg-dry		0.9	SWC	ICP	12/06/94



ARI job number: J009 ARI Sample number: B

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 34.38

ID number: M94SC002

Project: 913-1101.604

Description:

Sampled: 11/11/94

Received: 11/21/94

leased by:

Chemists & Consultants

Analytical

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490

(206) 621-7523 (FAX)

# ANALYTICAL RESULT

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	25 mg/kg-dry		2	SWN	GFA	12/02/94
7440-43-9	Cadmium	28.2 mg/kg-dry		0.9	SWC	ICP	12/07/94
7440-50-8	Copper	9.5 mg/kg-dry		0.9	SWC	ICP	12/07/94
7439-98-7	Molybdenum	2 mg/kg-dry	U	2	SWC	ICP	12/07/94
7440-02-0	Nickel	40 mg/kg-dry		5	SWC	ICP	12/07/94
7782-49-2	Selenium	4 mg/kg-dry		1	SWN	GFA	12/01/94
7440-22-4	Silver	0.30 mg/kg-dry		0.04	SWN	GFA	12/07/94
7440-62-2	Vanadium	43.2 mg/kg-dry		0.9	SWC	ICP	12/07/94

7KL 1/12/95



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> 333 Ninth Ave. North Seattle, WA 98109-5187

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Consultants

(206) 621-6490

ID number: M94SC003

Project: 913-1101.604 Description:

Sampled: 11/11/94 Received: 11/21/94

Matrix: Soil % Solids: 29.97

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: C

Released by:

ANALYTICAL REŞ

CAS Number	Analyte	Concentration	C	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	27 mg/kg-dry		2	SWN	GFA	12/02/94
7440-43-9	Cadmium	26.7 mg/kg-dry		0.9	SWC	ICP	12/07/94
7440-50-8	Copper	9.4 mg/kg-dry		0.9	SWC	ICP	12/07/94
7439-98-7	Molybdenum	2 mg/kg-dry	ט	2	SWC	ICP	12/07/94
7440-02-0	Nickel	42 mg/kg-dry		5	SWC	ICP	12/07/94
7782-49-2	Selenium	5 mg/kg-dry		1	SWN	GFA	12/01/94
7440-22-4	Silver	0.33 mg/kg-dry		0.05	SWN	GFA	12/07/94
7440-62-2	Vanadium	47.2 mg/kg-dry		0.9	SWC	ICP	12/07/94



ID number: M94SC005

Project: 913-1101.604

Description:

Sampled: 11/11/94 Received: 11/21/94

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490

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Consultants

(206) 621-7523 (FAX)

% Solids: 39.49

ARI job number: J009

Client: Golder

Matrix: Soil

Contact: Kent Angelos

ARI Sample number: D

Released by:

## ANALYTICAL

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	32 mg/kg-dry		2	SWN	GFA	12/02/94
7440-43-9	Cadmium	35.6 mg/kg-dry		0.8	SWC	ICP	12/06/94
7440-50-8	Copper	13.7 mg/kg-dry		0.8	SWC	ICP	12/06/94
7439-98-7	Molybdenum	2 mg/kg-dry	Ū	2	SWC	ICP	12/06/94
7440-02-0	Nickel	50 mg/kg-dry		4	SWC	ICP	12/06/94
7782-49-2	Selenium	6 mg/kg-dry		1	SWN	GFA	12/01/94
7440-22-4	Silver	0.67 mg/kg-dry		0.08	SWN	GFA	12/09/94
7440-62-2	Vanadium	76.7 mg/kg-dry		0.8	SWC	ICP	12/06/94



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333 Ninth Ave. North

(206) 621-7523 (FAX)

Seattle, WA 98109-5187

(206) 621-6490

ID number: M94SC006 Project: 913-1101.604

Description:

Sampled: 11/11/94 Received: 11/21/94

% Solids: 40.46

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: E

Released by:

## ANALYTICAL

RESULTS

CAS Number	Analyte	Concentration	C	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	69 mg/kg-dry		4	SWN	GFA	12/02/94
7440-43-9	Cadmium	35.4 mg/kg-dry		0.7	SWC	ICP	12/06/94
7440-50-8	Copper	11.0 mg/kg-dry		0.7	SWC	ICP	12/06/94
7439-98-7	Molybdenum	2 mg/kg-dry	ט	2	SWC	ICP	12/06/94
7440-02-0	Nickel	43 mg/kg-dry		3	SWC	ICP	12/06/94
7782-49-2	Selenium	5 mg/kg-dry		1	SWN	GFA	12/01/94
7440-22-4	Silver	0.39 mg/kg-dry		0.04	SWN	GFA	12/09/94
7440-62-2	Vanadium	67.1 mg/kg-dry		0.7	SWC	ICP	12/06/94



Analytical

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Consultants

ID number: M94SC007

Project: 913-1101.604

Description:

Sampled: 11/11/94 Received: 11/21/94

(206) 62 (206) 62

% Solids: 46.13

ARI job number: J009

Client: Golder

Matrix: Soil

Contact: Kent Angelos

ARI Sample number: F

Released by: ___

(206) 621-6490 (206) 621-7523 (FAX)

333 Ninth Ave. North

Seattle, WA 98109-5187

## ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	rod	Prep	М	Analyzed
7440-38-2	Arsenic	47 mg/kg-dry		2	SWN	GFA	12/02/94
7440-43-9	Cadmium	39.6 mg/kg-dry		0.6	SWC	ICP	12/06/94
7440-50-8	Copper	12.3 mg/kg-dry		0.6	SWC	ICP	12/06/94
7439-98-7	Molybdenum	1 mg/kg-dry	ט	1	SWC	ICP	12/06/94
7440-02-0	Nickel	43 mg/kg-dry		3	SWC	ICP	12/06/94
7782-49-2	Selenium	4.2 mg/kg-dry		0.2	SWN	GFA	11/30/94
7440-22-4	Silver	0.59 mg/kg-dry		0.08	SWN	GFA	12/09/94
7440-62-2	Vanadium	71.6 mg/kg-dry		0.6	SWC	ICP	12/06/94



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Seattle, WA 95109-5187

(206) 621-6490

Matrix: Soil % Solids: 54.47

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: G

Released by:

Description:

ID number: M94SC019

Sampled: 11/14/94

Received: 11/21/94

Project: 913-1101.604

## ANALYTICAL

CAS Number	Analyte	Concentration	c	LOD	Prep	м	Analyzed
7440-38-2	Arsenic	15 mg/kg-dry		2	SWN	GFA	12/02/94
7440-43-9	Cadmium	18.3 mg/kg-dry		0.7	SWC	ICP	12/06/94
7440-50-8	Copper	12.9 mg/kg-dry		0.7	SWC	ICP	12/06/94
7439-98-7	Molybdenum	2 mg/kg-dry	U	2	SWC	ICP	12/06/94
7440-02-0	Nickel	34 mg/kg-dry		3	SWC	ICP	12/06/94
7782-49-2	Selenium	3.3 mg/kg-dry		0.9	SWN	GFA	12/01/94
7440-22-4	Silver	0.36 mg/kg-dry		0.07	SWN	GFA	12/07/94
7440-62-2	Vanadium	51.5 mg/kg-dry		0.7	SWC	ICP	12/06/94

1/12/45



ARI job number: J009 ARI Sample number: H

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 37.86

Project: 913-1101.604

Description:

Sampled: 11/14/94

ID number: M94SC020

Received: 11/21/94

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ANALYTICAL REGULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	27 mg/kg-dry		2	SWN	GFA	12/02/94
7440-43-9	Cadmium	43.0 mg/kg-dry		0.5	SWC	ICP	12/07/94
7440-50-8	Copper	27.6 mg/kg-dry		0.5	SWC	ICP	12/07/94
7439-98-7	Molybdenum	2 mg/kg-dry		1	SWC	ICP	12/07/94
7440-02-0	Nickel	44 mg/kg-dry		2	SWC	ICP	12/07/94
7782-49-2	Selenium	11 mg/kg-dry		1	SWN	GFA	12/01/94
7440-22-4	Silver	0.46 mg/kg-dry		0.05	SWN	GFA	12/09/94
7440-62-2	Vanadium	165 mg/kg-dry		0.5	SWC	ICP	12/07/94



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ID number: M94SC021

Project: 913-1101.604 Description:

> Sampled: 11/14/94 Received: 11/21/94

% Solids: 33.42

ARI job number: J009

Client: Golder

Matrix: Soil

Contact: Kent Angelos

ARI Sample number: I

#### ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	18 mg/kg-dry		2	SWN	GFA	12/02/94
7440-43-9	Cadmium	31.2 mg/kg-dry		0.4	SWC	ICP	12/06/94
7440-50-8	Copper	13.9 mg/kg-dry		0.4	SWC	ICP	12/06/94
7439-98-7	Molybdenum	1 mg/kg-dry	Ū	1	SWC	ICP	12/06/94
7440-02-0	Nickel	39 mg/kg-dry		2	SWC	ICP	12/06/94
7782-49-2	Selenium	6 mg/kg-dry		1	SWN	GFA	12/05/94
7440-22-4	Silver	0.30 mg/kg-dry		0.05	SWN	GFA	12/07/94
7440-62-2	Vanadium	82.3 mg/kg-dry		0.4	SWC	ICP	12/06/94



ID number: M94SC022

Project: 913-1101.604

Description:

Sampled: 11/14/94 Received: 11/21/94

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#### ANALYTICAL RESULTS

ARI job number: J009

Client: Golder

Matrix: Soil

% Solids: 23.55

Contact: Kent Angelos

ARI Sample number: J

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	33 mg/kg-dry		3	SWN	GFA	12/02/94
7440-43-9	Cadmium	52.4 mg/kg-dry		0.7	SWC	ICP	12/06/94
7440-50-8	Copper	32.3 mg/kg-dry		0.7	SWC	ICP	12/06/94
7439-98-7	Molybdenum	3 mg/kg-dry		2	SWC	ICP	12/06/94
7440-02-0	Nickel	46 mg/kg-dry		4	SWC	ICP	12/06/94
7782-49-2	Selenium	14 mg/kg-dry		2	SWN	GFA	12/01/94
7440-22-4	Silver	0.6 mg/kg-dry		0.1	SWN	GFA	12/14/94
7440-62-2	Vanadium	240 mg/kg-dry		0.7	SWC	ICP	12/06/94



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ARI job number: J009 ARI Sample number: K

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 21.49

ID number: M94SC023 Project: 913-1101.604

Description:

Sampled: 11/14/94 Received: 11/21/94

Released by:

ANALYTICAL

CAS Number	Analyte	Concentration	C	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	35 mg/kg-dry		3	SWN	GFA	12/02/94
7440-43-9	Cadmium	56.9 mg/kg-dry		0.7	SWC	ICP	12/06/94
7440-50-8	Copper	36.6 mg/kg-dry		0.7	SWC	ICP	12/06/94
7439-98-7	Molybdenum	2 mg/kg-dry		2	SWC	ICP	12/06/94
7440-02-0	Nickel	47 mg/kg-dry		3	SWC	ICP	12/06/94
7782-49-2	Selenium	15 mg/kg-dry		2	SWN	GFA	12/01/94
7440-22-4	Silver	0.7 mg/kg-dry		0.1	SWN	GFA	12/09/94
7440-62-2	Vanadium	267 mg/kg-dry		0.7	SWC	ICP	12/06/94



ARI job number: J009 ARI Sample number: L

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 17.02

ID number: M94SC024

Project: 913-1101.604

Description:

Sampled: 11/14/94

Received: 11/21/94

Released by:

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## ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	34 mg/kg-dry		6	SWN	GFA	12/02/94
7440-43-9	Cadmium	61 mg/kg-dry		1	SWC	ICP	12/06/94
7440-50-8	Copper	37 mg/kg-dry		1	SWC	ICP	12/06/94
7439-98-7	Molybdenum	3 mg/kg-dry	ט	3	SWC	ICP	12/06/94
7440-02-0	Nickel	47 mg/kg-dry		6	SWC	ICP	12/06/94
7782-49-2	Selenium	13 mg/kg-dry		1	SWN	GFA	12/01/94
7440-22-4	Silver	0.4 mg/kg-dry		0.1	SWN	GFA	12/07/94
7440-62-2	Vanadium	290 mg/kg-dry		1	SWC	ICP	12/06/94



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ARI job number: J009 ARI Sample number: M

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 45.21

Description:

ID number: M94SC026

Sampled: 11/14/94

Received: 11/21/94

Project: 913-1101.604

ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	C	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	24 mg/kg-dry		2	SWN	GFA	12/02/94
7440-43-9	Cadmium	14.6 mg/kg-dry		0.6	SWC	ICP	12/06/94
7440-50-8	Copper	10.8 mg/kg-dry		0.6	SWC	ICP	12/06/94
7439-98-7	Molybdenum	2 mg/kg-dry	ט	2	SWC	ICP	12/06/94
7440-02-0	Nickel	48 mg/kg-dry		3	SWC	ICP	12/06/94
7782-49-2	Selenium	8.1 mg/kg-dry		0.9	SWN	GFA	12/01/94
7440-22-4	Silver	0.08 mg/kg-dry		0.03	SWN	GFA	12/07/94
7440-62-2	Vanadium	67.5 mg/kg-dry		0.6	SWC	ICP	12/06/94

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ARI job number: J009 ARI Sample number: N

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 60.11

Project: 913-1101.604

Description:

Sampled: 11/14/94 Received: 11/21/94

ID number: M94SC027

#### RESULTS ANALYTICAL

CAS Number	Analyte	Concen	tration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	21	mg/kg-dry		1	SWN	GFA	12/02/94
7440-43-9	Cadmium	11.9	mg/kg-dry		0.5	SWC	ICP	12/06/94
7440-50-8	Copper	10.2	mg/kg-dry		0.5	SWC	ICP	12/06/94
7439-98-7	Molybdenum	1	mg/kg-dry	ט	1	SWC	ICP	12/06/94
7440-02-0	Nickel	34	mg/kg-dry		3	SWC	ICP	12/06/94
7782-49-2	Selenium	4.9	mg/kg-dry		0.7	SWN	GFA	12/01/94
7440-22-4	Silver	0.06	mg/kg-dry		0.03	SWN	GFA	12/07/94
7440-62-2	Vanadium	49.1	mg/kg-dry		0.5	SWC	ICP	12/06/94



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ID number: M94SC028

Project: 913-1101.604
Description:

Sampled: 11/14/94

Received: 11/21/94

% Solids: 46.06

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: 0

Released by:

## ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	16 mg/kg-dry		2	SWN	GFA	12/02/94
7440-43-9	Cadmium	13.5 mg/kg-dry		0.3	SWC	ICP	12/07/94
7440-50-8	Copper	11.2 mg/kg-dry		0.3	SWC	ICP	12/07/94
7439-98-7	Molybdenum	1.1 mg/kg-dry		0.8	SWC	ICP	12/07/94
7440-02-0	Nickel	37 mg/kg-dry		2	SWC	ICP	12/07/94
7782-49-2	Selenium	10 mg/kg-dry		1	SWN	GFA	12/01/94
7440-22-4	Silver	0.08 mg/kg-dry		0.04	SWN	GFA	12/09/94
7440-62-2	Vanadium	62.0 mg/kg-dry		0.3	SWC	ICP	12/07/94



**ANALYTICAL** RESOURCES

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INCORPORATED

% Solids: 53.14

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: P

ID number: M94SC029

Project: 913-1101.604

Description:

Sampled: 11/14/94 Received: 11/21/94

Released by:

ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	C	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	28 mg/kg-dry		1	SWN	GFA	12/02/94
7440-43-9	Cadmium	12.1 mg/kg-dry		0.7	SWC	ICP	12/06/94
7440-50-8	Copper	7.7 mg/kg-dry		0.7	SWC	ICP	12/06/94
7439-98-7	Molybdenum	2 mg/kg-dry	Ū	2	SWC	ICP	12/06/94
7440-02-0	Nickel	44 mg/kg-dry		3	SWC	ICP	12/06/94
7782-49-2	Selenium	5.8 mg/kg-dry		0.7	SWN	GFA	12/01/94
7440-22-4	Silver	0.07 mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	59.7 mg/kg-dry		0.7	SWC	ICP	12/06/94



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ID number: M94SC030

Project: 913-1101.604 Description:

Sampled: 11/14/94 Received: 11/21/94

Matrix: Soil % Solids: 47.65

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: Q

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CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	18 mg/kg-dry		1	SWN	GFA	12/02/94
7440-43-9	Cadmium	14.1 mg/kg-dry		0.6	SWC	ICP	12/06/94
7440-50-8	Copper	9.7 mg/kg-dry		0.6	SWC	ICP	12/06/94
7439-98-7	Molybdenum	1 mg/kg-dry	Ü	1	SWC	ICP	12/06/94
7440-02-0	Nickel	42 mg/kg-dry		3	SWC	ICP	12/06/94
7782-49-2	Selenium	11 mg/kg-dry		1	SWN	GFA	12/05/94
7440-22-4	Silver	0.10 mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	62.1 mg/kg-dry		0.6	SWC	ICP	12/06/94



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ARI job number: J009 ARI Sample number: R

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 16.26

#### ANALYTICAL RESULTS

Released by:

Description:

ID number: M94SC033

Sampled: 11/15/94

Received: 11/21/94

Project: 913-1101.604

CAS Number	Analyte	Concentration	C	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	18 mg/kg-dry		3	SWN	GFA	12/06/94
7440-43-9	Cadmium	47.9 mg/kg-dry		0.9	SWC	ICP	12/06/94
7440-50-8	Copper	15.5 mg/kg-dry		0.9	SWC	ICP	12/06/94
7439-98-7	Molybdenum	6 mg/kg-dry		2	SWC	ICP	12/06/94
7440-02-0	Nickel	90 mg/kg-dry		4	SWC	ICP	12/06/94
7782-49-2	Selenium	93 mg/kg-dry		3	SWN	GFA	12/01/94
7440-22-4	Silver	0.2 mg/kg-dry		0.1	SWN	GFA	12/12/94
7440-62-2	Vanadium	102 mg/kg-dry		0.9	SWC	ICP	12/06/94



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ID number: M94SC034

Project: 913-1101.604
Description:

Sampled: 11/15/94

Received: 11/21/94

% Solids: 15.68

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: S

Released by:

## ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	18 mg/kg-dry		3	SWN	GFA	12/06/94
7440-43-9	Cadmium	43 mg/kg-dry		1	SWC	ICP	12/06/94
7440-50-8	Copper	13 mg/kg-dry		1	SWC	ICP	12/06/94
7439-98-7	Molybdenum	13 mg/kg-dry		2	SWC	ICP	12/06/94
7440-02-0	Nickel	115 mg/kg-dry		5	SWC	ICP	12/06/94
7782-49-2	Selenium	97 mg/kg-dry		3	SWN	GFA	12/01/94
7440-22-4	Silver	0.1 mg/kg-dry		0.1	SWN	GFA	12/09/94
7440-62-2	Vanadium	94 mg/kg-dry		1	SWC	ICP	12/06/94

J

DKK 1/12/95



ARI job number: J009
ARI Sample number: T

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 19.92

ID number: M94SC035

Project: 913-1101.604

Description:

Sampled: 11/15/94

Received: 11/21/94

Released by:

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## ANALYTICAL RESU

CAS Number	Analyte	Concent	tration	C	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	18	mg/kg-dry		2	SWN	GFA	12/06/94
7440-43-9	Cadmium	47.1	mg/kg-dry		0.7	SWC	ICP	12/06/94
7440-50-8	Copper	11.6	mg/kg-dry		0.7	SWC	ICP	12/06/94
7439-98-7	Molybdenum	6	mg/kg-dry		2	SWC	ICP	12/06/94
7440-02-0	Nickel	118	mg/kg-dry		4	SWC	ICP	12/06/94
7782-49-2	Selenium	83	mg/kg-dry		2	SWN	GFA	12/01/94
7440-22-4	Silver	0.09	mg/kg-dry	Ū	0.09	SWN	GFA	12/09/94
7440-62-2	Vanadium	96.6	mg/kg-dry		0.7	SWC	ICP	12/06/94



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ID number: M94SC036 Project: 913-1101.604

Description:

Sampled: 11/15/94 Received: 11/21/94

% Solids: 21.13

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: U

## ANALYTICAL

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	21 mg/kg-dry		4	SWN	GFA	12/02/94
7440-43-9	Cadmium	42.4 mg/kg-dry		0.8	SWC	ICP	12/07/94
7440-50-8	Copper	13.0 mg/kg-dry		0.8	SWC	ICP	12/07/94
7439-98-7	Molybdenum	7 mg/kg-dry		2	SWC	ICP	12/07/94
7440-02-0	Nickel	126 mg/kg-dry		4	SWC	ICP	12/07/94
7782-49-2	Selenium	81 mg/kg-dry		4	SWN	GFA	12/05/94
7440-22-4	Silver	0.11 mg/kg-dry		0.08	SWN	GFA	12/09/94
7440-62-2	Vanadium	96.1 mg/kg-dry		0.8	SWC	ICP	12/07/94



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ID number: M94SC038

Project: 913-1101.604

Description:

Sampled: 11/15/94 Received: 11/21/94

Matrix: Soil

ARI job number: J009

ARI Sample number: V

% Solids: 20.13

Client: Golder

Contact: Kent Angelos

ANALYTICAL

CAS Number	Analyte	Concentration	С	LOD	Prep	м	Analyzed
7440-38-2	Arsenic	22 mg/kg-dry		2	SWN	GFA	12/06/94
7440-43-9	Cadmium	63.5 mg/kg-dry		0.9	SWC	ICP	12/07/94
7440-50-8	Copper	16.8 mg/kg-dry		0.9	SWC	ICP	12/07/94
7439-98-7	Molybdenum	4 mg/kg-dry		2	SWC	ICP	12/07/94
7440-02-0	Nickel	81 mg/kg-dry		5	SWC	ICP	12/07/94
7782-49-2	Selenium	63 mg/kg-dry		2	SWN	GFA	12/01/94
7440-22-4	Silver	0.1 mg/kg-dry		0.1	SWN	GFA	12/12/94
7440-62-2	Vanadium	76.4 mg/kg-dry		0.9	SWC	ICP	12/07/94

DKK 1/12/45



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ID number: M94SC039

Project: 913-1101.604 Description:

Sampled: 11/15/94 Received: 11/21/94

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: W

% Solids: 33.46

Released by:

ANALYTICAL

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	24 mg/kg-dry		3	SWN	GFA	12/02/94
7440-43-9	Cadmium	5.0 mg/kg-dry		0.9	SWC	ICP	12/08/94
7440-50-8	Copper	5.3 mg/kg-dry		0.9	SWC	ICP	12/08/94
7439-98-7	Molybdenum	2 mg/kg-dry	ט	2	SWC	ICP	12/08/94
7440-02-0	Nickel	105 mg/kg-dry		5	SWC	ICP	12/08/94
7782-49-2	Selenium	15 mg/kg-dry		3	SWN	GFA	12/05/94
7440-22-4	Silver	0.06 mg/kg-dry	ט	0.06	SWN	GFA	12/09/94
7440-62-2	Vanadium	66.7 mg/kg-dry		0.9	SWC	ICP	12/08/94



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ID number: M94SC040

Project: 913-1101.604

Client: Golder Description:

Contact: Kent Angelos

Matrix: Soil

% Solids: 22.84

ARI job number: J009

ARI Sample number: X

Sampled: 11/15/94 Received: 11/21/94

Released by:

RESULTS ANALYTICAL

CAS Number	Analyte	Concent	ration	C	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	22	mg/kg-dry		4	SWN	GFA	12/02/94
7440-43-9	Cadmium	47.0	mg/kg-dry		0.7	SWC	ICP	12/07/94
7440-50-8	Copper	12.6	mg/kg-dry		0.7	SWC	ICP	12/07/94
7439-98-7	Molybdenum	3	mg/kg-dry		2	SWC	ICP	12/07/94
7440-02-0	Nickel	59	mg/kg-dry		4	SWC	ICP	12/07/94
7782-49-2	Selenium	50	mg/kg-dry		2	SWN	GFA	12/01/94
7440-22-4	Silver	0.07	mg/kg-dry		0.07	SWN	GFA	12/09/94
7440-62-2	Vanadium	74.1	mg/kg-dry		0.7	SWC	ICP	12/07/94

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ARI job number: J009 ARI Sample number: Y

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 22.61

Released by:

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Description:

ID number: M94SC041

Sampled: 11/15/94

Received: 11/21/94

Project: 913-1101.604

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	24 mg/kg-dry		2	SWN	GFA	12/06/94
7440-43-9	Cadmium	45.8 mg/kg-dry		0.7	SWC	ICP	12/07/94
7440-50-8	Copper	11.4 mg/kg-dry		0.7	SWC	ICP	12/07/94
7439-98-7	Molybdenum	4 mg/kg-dry		2	SWC	ICP	12/07/94
7440-02-0	Nickel	72 mg/kg-dry		3	SWC	ICP	12/07/94
7782-49-2	Selenium	46 mg/kg-dry		2	SWN	GFA	12/01/94
7440-22-4	Silver	0.08 mg/kg-dry	ט	0.08	SWN	GFA	12/09/94
7440-62-2	Vanadium	65.2 mg/kg-dry		0.7	SWC	ICP	12/07/94

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ARI job number: J009 ARI Sample number: Z

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 27.13

Sampled: 11/15/94 Received: 11/21/94

ID number: M94SC042

Project: 913-1101.604

RESULTS

Description:

ANALYTICAL

CAS Number	Analyte	Concentration	c	LOD	Prep	М	Analyzed	
7440-38-2	Arsenic	43 mg/kg-dry		3	SWN	GFA	12/02/94	
7440-43-9	Cadmium	20.5 mg/kg-dry		0.6	SWC	ICP	12/07/94	
7440-50-8	Copper	7.7 mg/kg-dry		0.6	SWC	ICP	12/07/94	
7439-98-7	Molybdenum	3 mg/kg-dry		1	SWC	ICP	12/07/94	
7440-02-0	Nickel	122 mg/kg-dry		3	SWC	ICP	12/07/94	
7782-49-2	Selenium	21 mg/kg-dry		1	SWN	GFA	12/01/94	
7440-22-4	Silver	0.06 mg/kg-dry	ט	0.06	SWN	GFA	12/09/94	
7440-62-2	Vanadium	85.7 mg/kg-dry		0.6	SWC	ICP	12/07/94	



Analytical



Chemists & Consultants

Seattle, WA 98109-5187

333 Ninth Ave. North

(206) 621-6490 (206) 621-7523 (FAX)

ARI job number: J009 ARI Sample number: AA

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 44.19

Released by:

ANALYTICAL

Description:

ID number: M94SC044

Sampled: 11/15/94

Received: 11/21/94

Project: 913-1101.604

CAS Number	Analyte	Concentration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	5.8 mg/kg-dry		0.4	SWN	GFA	12/06/94
7440-43-9	· Cadmium	26.2 mg/kg-dry		0.7	SWC	ICP	12/07/94
7440-50-8	Copper	9.0 mg/kg-dry		0.7	SWC	ICP	12/07/94
7439-98-7	Molybdenum	2 mg/kg-dry	ט	2	SWC	ICP	12/07/94
7440-02-0	Nickel	53 mg/kg-dry		3	SWC	ICP	12/07/94
7782-49-2	Selenium	20 mg/kg-dry		1	SWN	GFA	12/01/94
7440-22-4	Silver	0.04 mg/kg-dry	ט	0.04	SWN	GFA	12/09/94
7440-62-2	Vanadium	45.7 mg/kg-dry		0.7	SWC	ICP	12/07/94



Analytical ID number: M94SC045 Chemists & Project: 913-1101.604 Consultants

Description:

Sampled: 11/15/94 Received: 11/21/94

Seattle, WA 98109-5187 (206) 621-6490

(206) 621-7523 (FAX)

333 Ninth Ave. North

% Solids: 42.54

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: AB

#### ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	5.9 mg/kg-dry		0.4	SWN	GFA	12/06/94
7440-43-9	Cadmium	24 mg/kg-dry		2	SWC	ICP	12/08/94
7440-50-8	Copper	11 mg/kg-dry		2	SWC	ICP	12/08/94
7439-98-7	Molybdenum	4 mg/kg-dry	ט	4	SWC	ICP	12/08/94
7440-02-0	Nickel	54 mg/kg-dry		8	SWC	ICP	12/08/94
7782-49-2	Selenium	22 mg/kg-dry		2	SWN	GFA	12/05/94
7440-22-4	Silver	0.04 mg/kg-dry		0.04	SWN	GFA	12/09/94
7440-62-2	Vanadium	51 mg/kg-dry		2	SWC	ICP	12/08/94

DCR 1/12/45



# ANALYTICAL RESOURCES

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Consultants

% Solids: 46.13

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: AC

Released by:

Description:

ID number: M94SC046

Sampled: 11/15/94

Received: 11/21/94

Project: 913-1101.604

#### ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	5.7 mg/kg-d	ry	0.4	SWN	GFA	12/06/94
7440-43-9	Cadmium	23.7 mg/kg-d	ry	0.7	SWC	ICP	12/08/94
7440-50-8	Copper	6.7 mg/kg-d	ry	0.7	SWC	ICP	12/08/94
7439-98-7	Molybdenum	2 mg/kg-d	ry U	2	SWC	ICP	12/08/94
7440-02-0	Nickel	55 mg/kg-d	ry	3	SWC	ICP	12/08/94
7782-49-2	Selenium	22 mg/kg-d:	ry	2	SWN	GFA	12/05/94
7440-22-4	Silver	0.04 mg/kg-d:	ry	0.04	SWN	GFA	12/09/94
7440-62-2	Vanadium	41.8 mg/kg-d	ry	0.7	SWC	ICP	12/08/94



ANALYTICAL RESOURCES

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**INCORPORATED** 

% Solids: 43.57

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: AD

Description: Sampled: 11/16/94 Received: 11/21/94

ID number: M94SC049

Project: 913-1101.604

ANALYTICAL RESULTS

CAS Number	Analyte	Concentratio	n C	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	8.3 mg/kg	-dry	0.9	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.9 mg/kg	-dry	0.3	SWC	ICP	12/07/94
7440-50-8	Copper	10.7 mg/kg	-dry	0.3	SWC	ICP	12/07/94
7439-98-7	Molybdenum	0.7 mg/kg	-dry U	0.7	SWC	ICP	12/07/94
7440-02-0	Nickel	63 mg/kg	-dry	1	SWC	ICP	12/07/94
7782-49-2	Selenium	1.6 mg/kg	-dry	0.9	SWN	GFA	12/05/94
7440-22-4	Silver	0.06 mg/kg	-dry	0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	42.2 mg/kg	-dry	0.3	SWC	ICP	12/07/94



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ARI job number: J009 ARI Sample number: AE

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 54.27

Description:

Sampled: 11/16/94 Received: 11/21/94

ID number: M94SC050

Project: 913-1101.604

Released by:

ANALYTICAL

CAS Number	Analyte	Concentration	C	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	7.7 mg/kg-dry		0.8	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.9 mg/kg-dry		0.3	SWC	ICP	12/07/94
7440-50-8	Copper	12.2 mg/kg-dry		0.3	SWC	ICP	12/07/94
7439-98-7	Molybdenum	0.9 mg/kg-dry	ט	0.9	SWC	ICP	12/07/94
7440-02-0	Nickel	95 mg/kg-dry		2	SWC	ICP	12/07/94
7782-49-2	Selenium	1.2 mg/kg-dry		0.8	SWN	GFA	12/01/94
7440-22-4	Silver	0.03 mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	47.4 mg/kg-dry		0.3	SWC	ICP	12/07/94

DKR 1/13/95



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ID number: M94SC051

Project: 913-1101.604

Description:

Sampled: 11/16/94 Received: 11/21/94

Matrix: Soil

Client: Golder

ARI job number: J009

ARI Sample number: AF

% Solids: 35.77

Contact: Kent Angelos

Released by:

#### RESULTS ANALYTICAL

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	11 mg/kg-dry		1	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.8 mg/kg-dry		0.4	SWC	ICP	12/07/94
7440-50-8	Copper	12.0 mg/kg-dry		0.4	SWC	ICP	12/07/94
7439-98-7	Molybdenum	1 mg/kg-dry		1	SWC	ICP	12/07/94
7440-02-0	Nickel	98 mg/kg-dry		2	SWC	ICP	12/07/94
7782-49-2	Selenium	0.5 mg/kg-dry	บ	0.5	SWN	GFA	12/07/94
7440-22-4	Silver	0.06 mg/kg-dry		0.05	SWN	GFA	12/09/94
7440-62-2	Vanadium	48.6 mg/kg-dry		0.4	SWC	ICP	12/07/94



ARI job number: J009

Client: Golder

Matrix: Soil

% Solids: 50.76

Contact: Kent Angelos

ARI Sample number: AG

#### ANALYTICAL RESOURCES INCORPORATED

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ID number: M94SC052

Project: 913-1101.604

Description:

Sampled: 11/16/94 Received: 11/21/94

Released by:

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(206) 621-6490 (206) 621-7523 (FAX)

# ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	8.5 mg/kg-dry		0.8	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.7 mg/kg-dry	ט	0.7	SWC	ICP	12/08/94
7440-50-8	Copper	12.5 mg/kg-dry		0.7	SWC	ICP	12/08/94
7439-98-7	Molybdenum	2 mg/kg-dry	ט	2	SWC	ICP	12/08/94
7440-02-0	Nickel	85 mg/kg-dry		3	SWC	ICP	12/08/94
7782-49-2	Selenium	0.2 mg/kg-dry		0.2	SWN	GFA	12/07/94
7440-22-4	Silver	0.03 mg/kg-dry	ט	0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	56.0 mg/kg-dry		0.7	SWC	ICP	12/08/94



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ID number: M94SC053

Project: 913-1101.604

Description: Sampled: 11/16/94

Received: 11/21/94

% Solids: 32.16

ARI job number: J009

Client: Golder

Matrix: Soil

Contact: Kent Angelos

ARI Sample number: AH

#### ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	c	LOD	Prep	м	Analyzed
7440-38-2	Arsenic	8 mg/kg-dry		1	SWN	GFA	12/06/94
7440-43-9	Cadmium	1.0 mg/kg-dry		0.6	SWC	ICP	12/07/94
7440-50-8	Copper	12.1 mg/kg-dry		0.6	SWC	ICP	12/07/94
7439-98-7	Molybdenum	1 mg/kg-dry	บ	1	SWC	ICP	12/07/94
7440-02-0	Nickel	73 mg/kg-dry		3	SWC	ICP	12/07/94
7782-49-2	Selenium	2 mg/kg-dry		1	SWN	GFA	12/15/94
7440-22-4	Silver	0.05 mg/kg-dry		0.04	SWN	GFA	12/09/94
7440-62-2	Vanadium	45.3 mg/kg-dry		0.6	SWC	ICP	12/07/94



ARI job number: J009 ARI Sample number: AI

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 32.21

Project: 913-1101.604
Description:

Sampled: 11/16/94

ID number: M94SC054

Received: 11/21/94

eleased by:

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333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490

(206) 621-7523 (FAX)

# ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	7.5 mg/kg-dry		0.6	SWN	GFA	12/06/94
7440-43-9	Cadmium	1.1 mg/kg-dry		0.5	SWC	ICP	12/07/94
7440-50-8	Copper	11.6 mg/kg-dry		0.5	SWC	ICP	12/07/94
7439-98-7	Molybdenum	1 mg/kg-dry	Ū	1	SWC	ICP	12/07/94
7440-02-0	Nickel	67 mg/kg-dry		2	SWC	ICP	12/07/94
7782-49-2	Selenium	0.5 mg/kg-dry		0.3	SWN	GFA	12/05/94
7440-22-4	Silver	0.06 mg/kg-dry	ט	0.06	SWN	GFA	12/09/94
7440-62-2	Vanadium	44.4 mg/kg-dry		0.5	SWC	ICP	12/07/94



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ID number: M94SC057
Project: 913-1101.604

Description:

Sampled: 11/16/94 Received: 11/21/94 333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

Matrix: Soil % Solids: 19.62

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: AJ

Released by:

ANALYTICAL RESUL

CAS Number	Analyte	Concentration	C	LOD	Prep	м	Analyzed
7440-38-2	Arsenic	5.7 mg/kg-dry		0.5	SWN	GFA	12/06/94
7440-43-9	Cadmium	3.4 mg/kg-dry		0.8	SWC	ICP	12/07/94
7440-50-8	Copper	10.5 mg/kg-dry		0.8	SWC	ICP	12/07/94
7439-98-7	Molybdenum	2 mg/kg-dry	ט	2	SWC	ICP	12/07/94
7440-02-0	Nickel	26 mg/kg-dry		4	SWC	ICP	12/07/94
7782-49-2	Selenium	2.5 mg/kg-dry		0.9	SWN	GFA	12/05/94
7440-22-4	Silver	0.09 mg/kg-dry	ט	0.09	SWN	GFA	12/09/94
7440-62-2	Vanadium	64.1 mg/kg-dry		0.8	SWC	ICP	12/07/94



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ID number: M94SC058

Project: 913-1101.604
Description:

Sampled: 11/16/94 Received: 11/21/94

Contact: Kent Angelos Matrix: Soil

% Solids: 19.24

Client: Golder

ARI job number: J009

ARI Sample number: AK

Released by:

ANALYTICAL RESUL

CAS Number	Analyte	Concentration	C	rod	Prep	М	Analyzed
7440-38-2	Arsenic	6.4 mg/kg-dry		0.8	SWN	GFA	12/06/94
7440-43-9	Cadmium	3.3 mg/kg-dry		0.7	SWC	ICP	12/07/94
7440-50-8	Copper	11.1 mg/kg-dry		0.7	SWC	ICP	12/07/94
7439-98-7	Molybdenum	2 mg/kg-dry	ט	2	SWC	ICP	12/07/94
7440-02-0	Nickel	26 mg/kg-dry		4	SWC	ICP	12/07/94
7782-49-2	Selenium	2.6 mg/kg-dry		0.8	SWN	GFA	12/05/94
7440-22-4	Silver	0.09 mg/kg-dry		0.08	SWN	GFA	12/09/94
7440-62-2	Vanadium	67.4 mg/kg-dry		0.7	SWC	ICP	12/07/94



ARI job number: J009

Client: Golder

Matrix: Soil

% Solids: 25.33

Contact: Kent Angelos

ARI Sample number: AL

#### ANALYTICAL RESOURCES INCORPORATED

ID number: M94SC059

Project: 913-1101.604

Description:

Sampled: 11/16/94 Received: 11/21/94

Received: 11/21/94

Released by:

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(206) 621-7523 (FAX)

# ANALYTICAL RESUVLTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	6.4 mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	2.9 mg/kg-dry		0.6	SWC	ICP	12/07/94
7440-50-8	Copper	8.4 mg/kg-dry		0.6	SWC	ICP	12/07/94
7439-98-7	Molybdenum	1 mg/kg-dry	U	1	SWC	ICP	12/07/94
7440-02-0	Nickel	24 mg/kg-dry		3	SWC	ICP	12/07/94
7782-49-2	Selenium	3 mg/kg-dry		2	SWN	GFA	12/01/94
7440-22-4	Silver	0.09 mg/kg-dry		0.06	SWN	GFA	12/09/94
7440-62-2	Vanadium	65.7 mg/kg-dry		0.6	SWC	ICP	12/07/94

J



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ID number: M94SC063

Project: 913-1101.604

Description:

Sampled: 11/16/94 Received: 11/21/94

Matrix: Soil % Solids: 25.71

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: AM

#### ANALYTICAL RESÚLTS

CAS Number	Analyte	Concentration	C	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	6.4 mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	1 mg/kg-dry	ש	1	SWC	ICP	12/08/94
7440-50-8	Copper	8 mg/kg-dry		1	SWC	ICP	12/08/94
7439-98-7	Molybdenum	3 mg/kg-dry	ט	3	SWC	ICP	12/08/94
7440-02-0	Nickel	56 mg/kg-dry		6	SWC	ICP	12/08/94
7782-49-2	Selenium	3 mg/kg-dry		2	SWN	GFA	12/01/94
7440-22-4	Silver	0.09 mg/kg-dry		0.06	SWN	GFA	12/09/94
7440-62-2	Vanadium	52 mg/kg-dry		1	SWC	ICP	12/08/94

DKR 1/13/95



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(206) 621-6490 (206) 621-7523 (FAX)

ID number: M94SC064

Project: 913-1101.604

Description:

Sampled: 11/16/94 Received: 11/21/94

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: AN

% Solids: 10.00

ANALYTICAL RESTUTES

CAS Number	Analyte	Concent	ration	c	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	3.1	mg/kg-dry		0.7	SWN	GFA	12/06/94
7440-43-9	Cadmium	2	mg/kg-dry		1	SWC	ICP	12/07/94
7440-50-8	Copper	8	mg/kg-dry		1	SWC	ICP	12/07/94
7439-98-7	Molybdenum	3	mg/kg-dry	ט	3	SWC	ICP	12/07/94
7440-02-0	Nickel	13	mg/kg-dry		6	SWC	ICP	12/07/94
7782-49-2	Selenium	3	mg/kg-dry		1	SWN	GFA	12/07/94
7440-22-4	Silver	0.1	mg/kg-dry	บ	0.1	SWN	GFA	12/09/94
7440-62-2	Vanadium	31	mg/kg-dry		1	SWC	ICP	12/07/94

DXE 1/12/15



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ID number: M94SC065 Project: 913-1101.604

Description:

Sampled: 11/16/94 Received: 11/21/94 333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

% Solids: 14.23

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: AO

Released by:

## ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	2.8 mg/kg-dry		0.6	SWN	GFA	12/08/94
7440-43-9	Cadmium	1 mg/kg-dry	บ	1	SWC	ICP	12/12/94
7440-50-8	Copper	9 mg/kg-dry		1	SWC	ICP	12/12/94
7439-98-7	Molybdenum	3 mg/kg-dry	Ū	3	SWC	ICP -	12/12/94
7440-02-0	Nickel	15 mg/kg-dry		6	SWC	ICP	12/12/94
7782-49-2	Selenium	2.7 mg/kg-dry		0.6	SWN	GFA	12/07/94
7440-22-4	Silver	0.1 mg/kg-dry	ט	0.1	SWN	GFA	12/12/94
7440-62-2	Vanadium	36 mg/kg-dry		1	SWC	ICP	12/12/94



ARI job number: J009 ARI Sample number: AP

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 18.98

ID number: M94SC066

Project: 913-1101.604

Description:

Sampled: 11/16/94 Received: 11/21/94

Released by:

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# ANALYTICAL RESULTS

CAS Number	Analyte	Concen	tration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	4.0	mg/kg-dry		0.5	SWN	GFA	12/08/94
7440-43-9	Cadmium	1	mg/kg-dry	ט	1	SWC	ICP	12/12/94
7440-50-8	Copper	8	mg/kg-dry		1	SWC	ICP	12/12/94
7439-98-7	Molybdenum	2	mg/kg-dry	ט	2	SWC	ICP	12/12/94
7440-02-0	Nickel	29	mg/kg-dry		5	SWC	ICP	12/12/94
7782-49-2	Selenium	2.2	mg/kg-dry		0.5	SWN	GFA	12/07/94
7440-22-4	Silver	0.09	mg/kg-dry	ט	0.09	SWN	GFA	12/12/94
7440-62-2	Vanadium	42	mg/kg-dry		1	SWC	ICP	12/12/94



ANALYTICAL RESOURCES

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INCORPORATED

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(206) 621-7523 (FAX)

ARI job number: J009 ARI Sample number: AQ

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 21.32

Description:

ID number: M94SC067

Sampled: 11/16/94

Received: 11/21/94

Project: 913-1101.604

ANALYTICAL

CAS Number	Analyte	Concentration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	3.9 mg/kg-dry		0.7	SWN	GFA	12/06/94
7440-43-9	Cadmium	1.3 mg/kg-dry		0.9	SWC	ICP	12/12/94
7440-50-8	Copper	6.5 mg/kg-dry		0.9	SWC	ICP	12/12/94
7439-98-7	Molybdenum	2 mg/kg-dry	ט	2	SWC	ICP	12/12/94
7440-02-0	Nickel	31 mg/kg-dry		5	SWC	ICP	12/12/94
7782-49-2	Selenium	2.4 mg/kg-dry		0.4	SWN	GFA	12/07/94
7440-22-4	Silver	0.07 mg/kg-dry	ט	0.07	SWN	GFA	12/12/94
7440-62-2	Vanadium	44.4 mg/kg-dry		0.9	SWC	ICP	12/12/94



ARI job number: J009 ARI Sample number: AR

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 42.09

ID number: M94AR001

Project: 913-1101.604

Description:

Sampled: 11/06/94 Received: 11/21/94

Released by:

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(206) 621-7523 (FAX)

## ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	2.9 mg/kg-dry		0.4	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.4 mg/kg-dry		0.4	SWC	ICP	12/12/94
7440-50-8	Copper	9.3 mg/kg-dry		0.4	SWC	ICP	12/12/94
7439-98-7	Mclybdenum	1 mg/kg-dry	ט	1	SWC	ICP	12/12/94
7440-02-0	Nickel	11 mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	1.2 mg/kg-dry		0.9	SWN	GFA	12/01/94
7440-22-4	Silver	0.06 mg/kg-dry		0.04	SWN	GFA	12/12/94
7440-62-2	Vanadium	26.3 mg/kg-dry		0.4	SWC	ICP	12/12/94



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ARI job number: J009 ARI Sample number: AS

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 49.39

Released by:

ANALYTICAL RESOULTS

Description:

ID number: M94AR002

Sampled: 11/07/94

Received: 11/21/94

Project: 913-1101.604

CAS Number	Analyte	Concentration	C	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	2.9 mg/kg-dry		0.4	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.5 mg/kg-dry		0.4	SWC	ICP	12/12/94
7440-50-8	Copper	7.8 mg/kg-dry		0.4	SWC	ICP	12/12/94
7439-98-7	Molybdenum	0.9 mg/kg-dry	ט	0.9	SWC	ICP	12/12/94
7440-02-0	Nickel	10 mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	0.7 mg/kg-dry		0.4	SWN	GFA	12/05/94
7440-22-4	Silver	0.05 mg/kg-dry		0.04	SWN	GFA	12/12/94
7440-62-2	Vanadium	21.8 mg/kg-dry		0.4	SWC	ICP	12/12/94



ARI job number: J009 ARI Sample number: AT

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 52.98

ID number: M94AR003

Project: 913-1101.604

Description:

Sampled: 11/07/94

Received: 11/21/94

Released by:

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## ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	2.3 mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.5 mg/kg-dry		0.3	SWC	ICP	12/12/94
7440-50-8	Copper	7.1 mg/kg-dry		0.3	SWC	ICP	12/12/94
7439-98-7	Molybdenum	0.9 mg/kg-dry	Ū	0.9	SWC	ICP	12/12/94
7440-02-0	Nickel	8 mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	0.6 mg/kg-dry		0.3	SWN	GFA	12/05/94
7440-22-4	Silver	0.04 mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	20.4 mg/kg-dry		0.3	SWC	ICP	12/12/94



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ID number: M94AR004

Project: 913-1101.604

Description:

Sampled: 11/07/94 Received: 11/21/94

Matrix: Soil % Solids: 59.96

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: AU

ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	2.3 mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.4 mg/kg-dry		0.3	SWC	ICP	12/12/94
7440-50-8	Copper	6.3 mg/kg-dry		0.3	SWC	ICP	12/12/94
7439-98-7	Molybdenum	0.8 mg/kg-dry	Ū	0.8	SWC	ICP	12/12/94
7440-02-0	Nickel	7 mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	0.5 mg/kg-dry		0.3	SWN	GFA	12/05/94
7440-22-4	Silver	0.05 mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	20.0 mg/kg-dry		0.3	SWC	ICP	12/12/94



ARI job number: J009 ARI Sample number: AV

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Sclids: 67.44

Released by:

ID number: M94AR005 Project: 913-1101.604

Description:

Sampled: 11/07/94

Received: 11/21/94

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#### RESULTS ANALYTICAL

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	2.4 mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.4 mg/kg-dry		0.2	SWC	ICP	12/12/94
7440-50-8	Copper	6.4 mg/kg-dry		0.2	SWC	ICP	12/12/94
7439-98-7	Molybdenum	0.6 mg/kg-dry	ט	0.6	SWC	ICP	12/12/94
7440-02-0	Nickel	8 mg/kg-dry		1	SWC	ICP	12/12/94
7782-49-2	Selenium	0.4 mg/kg-dry		0.3	SWN	GFA	12/05/94
7440-22-4	Silver	0.05 mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	18.6 mg/kg-dry		0.2	SWC	ICP	12/12/94



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ID number: M94AR006

Project: 913-1101.604

Description:

Sampled: 11/07/94 Received: 11/21/94

Matrix: Soil % Solids: 46.33

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: AW

Released by:

#### R E S U L T S ANALYTICAL

CAS Number	Analyte	Concentration	c	LOD	Prep	м	Analyzed
7440-38-2	Arsenic	2.7 mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.5 mg/kg-dry		0.4	SWC	ICP	12/12/94
7440-50-8	Copper	7.7 mg/kg-dry		0.4	SWC	ICP	12/12/94
7439-98-7	Molybdenum	1 mg/kg-dry	บ	1	SWC	ICP	12/12/94
7440-02-0	Nickel	9 mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	0.6 mg/kg-dry		0.3	SWN	GFA	12/05/94
7440-22-4	Silver	0.06 mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	22.6 mg/kg-dry		0.4	SWC	ICP	12/12/94



# **ANALYTICAL**

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ARI job number: J009 ARI Sample number: AX

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 57.81

Sampled: 11/08/94 Received: 11/21/94

Project: 913-1101.604

ID number: M94AR007

Released by:

Description:

ANALYTICAL

CAS Number	Analyte	Concen	tration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	2.4	mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.3	mg/kg-dry	ט	0.3	SWC	ICP	12/12/94
7440-50-8	Copper	4.8	mg/kg-dry		0.3	SWC	ICP	12/12/94
7439-98-7	Molybdenum	0.8	mg/kg-dry	Ū	0.8	SWC	ICP	12/12/94
7440-02-0	Nickel	6	mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	0.7	mg/kg-dry		0.3	SWN	GFA	12/07/94
7440-22-4	Silver	0.03	mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	14.6	mg/kg-dry		0.3	SWC	ICP	12/12/94



# ANALYTICAL RESOURCES

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ID number: M94AR009

Project: 913-1101.604

Description:

Sampled: 11/08/94 Received: 11/21/94

Matrix: Soil % Solids: 62.26

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: AY

Released by:

ANALYTICAL RES

CAS Number	Analyte	Concentration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	1.9 mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.3 mg/kg-dry	บ	0.3	SWC	ICP	12/12/94
7440-50-8	Copper	5.6 mg/kg-dry		0.3	SWC	ICP	12/12/94
7439-98-7	Molybdenum	0.8 mg/kg-dry	ט	0.8	SWC	ICP	12/12/94
7440-02-0	Nickel	7 mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	0.5 mg/kg-dry		0.3	SWN	GFA	12/05/94
7440-22-4	Silver	0.05 mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	17.9 mg/kg-dry		0.3	SWC	ICP	12/12/94

DXX 1/12/45



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ID number: M94AR011

Project: 913-1101.604
Description:

Sampled: 11/08/94 Received: 11/21/94

Matrix: Soil

ARI job number: J009

ARI Sample number: AZ

% Solids: 56.86

Client: Golder Contact: Kent Angelos

Released by:

ANALYTICAL RESULT

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	2.5 mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.5 mg/kg-dry		0.3	SWC	ICP	12/12/94
7440-50-8	Copper	7.2 mg/kg-dry		0.3	SWC	ICP	12/12/94
7439-98-7	Molybdenum	0.8 mg/kg-dry	Ū	0.8	SWC	ICP	12/12/94
7440-02-0	Nickel	8 mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	0.3 mg/kg-dry	ט	0.3	SWN	GFA	12/05/94
7440-22-4	Silver	0.05 mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	19.3 mg/kg-dry		0.3	SWC	ICP	12/12/94



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ARI job number: J009 ARI Sample number: BA

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 66.61

Released by:

Description:

ID number: M94AR012

Sampled: 11/08/94

Received: 11/21/94

Project: 913-1101.604

## ANALYTICAL

CAS Number	Analyte	Concentration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	2.4 mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	2.1 mg/kg-dry		0.3	SWC	ICP	12/12/94
7440-50-8	Copper	9.7 mg/kg-dry		0.3	SWC	ICP	12/12/94
7439-98-7	Molybdenum	0.7 mg/kg-dry	ט	0.7	SWC	ICP	12/12/94
7440-02-0	Nickel	12 mg/kg-dry		1	SWC	ICP	12/12/94
7782-49-2	Selenium	1.4 mg/kg-dry		0.7	SWN	GFA	12/07/94
7440-22-4	Silver	0.14 mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	32.0 mg/kg-dry		0.3	SWC	ICP	12/12/94



ARI job number: J009

Client: Golder

Matrix: Soil

% Solids: 66.21

Contact: Kent Angelos

ARI Sample number: BB

#### **ANALYTICAL RESOURCES** INCORPORATED

ID number: M94AR013 Project: 913-1101.604

Description:

Sampled: 11/08/94

Received: 11/21/94

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#### ANALYTICAL RESULTS

CAS Number	Analyte	Concentra	ation	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	3.4 mg	g/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	1.9 mg	g/kg-dry		0.6	SWC	ICP	12/12/94
7440-50-8	Copper	10.5 mg	g/kg-dry		0.6	SWC	ICP	12/12/94
7439-98-7	Molybdenum	1 mg	g/kg-dry	U	1	SWC	ICP	12/12/94
7440-02-0	Nickel	14 mg	g/kg-dry		3	SWC	ICP	12/12/94
7782-49-2	Selenium	1.3 mg	g/kg-dry		0.7	SWN	GFA	12/07/94
7440-22-4	Silver	0.14 mg	J/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	41.4 mg	g/kg-dry		0.6	SWC	ICP	12/12/94



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ARI job number: J009 ARI Sample number: BC

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 50.20

ID number: M94AR014 Project: 913-1101.604

Description:

Sampled: 11/08/94 Received: 11/21/94

ANALYTICAL

CAS Number	Analyte	Concen	tration	С	LOD	Prep	м	Analyzed
7440-38-2	Arsenic	2.4	mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.6	mg/kg-dry	Ū	0.6	SWC	ICP	12/12/94
7440-50-8	Copper	6.7	mg/kg-dry		0.6	SWC	ICP	12/12/94
7439-98-7	Molybdenum	2	mg/kg-dry	ט	2	SWC	ICP	12/12/94
7440-02-0	Nickel	8	mg/kg-dry		3	SWC	ICP	12/12/94
7782-49-2	Selenium	1.3	mg/kg-dry		0.8	SWN	GFA	12/07/94
7440-22-4	Silver	0.03	mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	18.5	mg/kg-dry		0.6	SWC	ICP	12/12/94



ID number: M94AR015

Project: 913-1101.604

Description:

Sampled: 11/08/94 Received: 11/21/94

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## ANALYTICAL

ARI job number: J009

Client: Golder

Matrix: Soil

% Solids: 57.82

Contact: Kent Angelos

ARI Sample number: BD

RESULTS

CAS Number	Analyte	Concentration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	1.9 mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.3 mg/kg-dry		0.3	SWC	ICP	12/12/94
7440-50-8	Copper	5.1 mg/kg-dry		0.3	SWC	ICP	12/12/94
7439-98-7	Molybdenum	0.8 mg/kg-dry	ט	0.8	SWC	ICP	12/12/94
7440-02-0	Nickel	6 mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	1.2 mg/kg-dry		0.7	SWN	GFA	12/07/94
7440-22-4	Silver	0.04 mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	14.2 mg/kg-dry		0.3	SWC	ICP	12/12/94



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ID number: M94AR016

Project: 913-1101.604

Description:

Sampled: 11/08/94 Received: 11/21/94

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: BE

% Solids: 68.58

ANALYTICAL

RE/SULTS

CAS Number	Analyte	Concentration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	1.7 mg/kg-dry		0.2	SWN	GFA	12/06/94
7440-43-9	Cadmium	0.2 mg/kg-dry	ט	0.2	SWC	ICP	12/12/94
7440-50-8	Copper	2.2 mg/kg-dry		0.2	SWC	ICP	12/12/94
7439-98-7	Molybdenum	0.6 mg/kg-dry	ט	0.6	SWC	ICP	12/12/94
7440-02-0	Nickel	3 mg/kg-dry		1	SWC	ICP	12/12/94
7782-49-2	Selenium	0.4 mg/kg-dry		0.2	SWN	GFA	12/07/94
7440-22-4	Silver	0.02 mg/kg-dry	บ	0.02	SWN	GFA	12/09/94
7440-62-2	Vanadium	7.5 mg/kg-dry		0.2	SWC	ICP	12/12/94

OKK 1/12/95



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ID number: M94AR017 Project: 913-1101.604

Description:

Sampled: 11/09/94 Received: 11/21/94

Matrix: Soil

% 'Solids: 47.00

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: BF

## ANALYTICAL

CAS Number	Analyte	Concentration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	5.1 mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	8 mg/kg-dry		2	SWC	ICP	12/12/94
7440-50-8	Copper	5 mg/kg-dry		2	SWC	ICP	12/12/94
7439-98-7	Molybdenum	4 mg/kg-dry	ט	4	SWC	ICP	12/12/94
7440-02-0	Nickel	14 mg/kg-dry		9	SWC	ICP	12/12/94
7782-49-2	Selenium	2.1 mg/kg-dry		0.9	SWN	GFA	12/07/94
7440-22-4	Silver	0.06 mg/kg-dry		0.04	SWN	GFA	12/09/94
7440-62-2	Vanadium	20 mg/kg-dry		2	SWC	ICP	12/12/94

DKX 1/12/95



ARI job number: J009

Client: Golder

Matrix: Soil

% Solids: 59.29

Contact: Kent Angelos

ARI Sample number: BG

ANALYTICAL RESOURCES INCORPORATED

ID number: M94AR019

Project: 913-1101.604

Description:

Sampled: 11/09/94 Received: 11/21/94

Released by:

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## ANALYTICAL RESULTS

CAS Number	Analyte	Concen	tration	c	LOD	Prep	м	Analyzed
7440-38-2	Arsenic	4.9	mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	4.9	mg/kg-dry		0.5	SWC	ICP	12/12/94
7440-50-8	Copper	8.6	mg/kg-dry		0.5	SWC	ICP	12/12/94
7439-98-7	Molybdenum	1	mg/kg-dry	ט	1	SWC	ICP	12/12/94
7440-02-0	Nickel	16	mg/kg-dry		3	SWC	ICP	12/12/94
7782-49-2	Selenium	1.8	mg/kg-dry		0.8	SWN	GFA	12/07/94
7440-22-4	Silver	0.13	mg/kg-dry		0.03	SWN	GFA	12/12/94
7440-62-2	Vanadium	26.4	mg/kg-dry		0.5	SWC	ICP	12/12/94

DFR 1/12/95



ARI job number: J009 ARI Sample number: BH

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 56.89

ID number: M94AR020

Project: 913-1101.604

Description:

Sampled: 11/09/94

Received: 11/21/94

Released by:

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# ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	4.1 mg/kg-dry		0.7	SWN	GFA	12/08/94
7440-43-9	Cadmium	5.1 mg/kg-dry		0.3	SWC	ICP	12/12/94
7440-50-8	Copper	6.8 mg/kg-dry		0.3	SWC	ICP	12/12/94
7439-98-7	Molybdenum	0.7 mg/kg-dry	ט	0.7	SWC	ICP	12/12/94
7440-02-0	Nickel	13 mg/kg-dry		1	SWC	ICP	12/12/94
7782-49-2	Selenium	1.6 mg/kg-dry		0.7	SWN	GFA	12/07/94
7440-22-4	Silver	0.08 mg/kg-dry		0.03	SWN	GFA	12/12/94
7440-62-2	Vanadium	20.7 mg/kg-dry		0.3	SWC	ICP	12/12/94



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(206) 621-6490

ARI job number: J009 ARI Sample number: BI

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 56.06

Released by:

Description:

ID number: M94AR021

Sampled: 11/09/94

Received: 11/21/94

Project: 913-1101.604

ANALYTICAL

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CAS Number	Analyte	Concentration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	3.6 mg/kg-dry		0.6	SWN	GFA	12/08/94
7440-43-9	Cadmium	5.0 mg/kg-dry		0.3	SWC	ICP	12/12/94
7440-50-8	Copper	5.9 mg/kg-dry		0.3	SWC	ICP	12/12/94
7439-98-7	Molybdenum	0.8 mg/kg-dry	ט	0.8	SWC	ICP	12/12/94
7440-02-0	Nickel	13 mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	1.4 mg/kg-dry		0.6	SWN	GFA	12/07/94
7440-22-4	Silver	0.10 mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	20.3 mg/kg-dry		0.3	SWC	ICP	12/12/94

DLR 1/12/45



ARI job number: J009 ARI Sample number: BJ

Client: Golder

Cilenc: Goidei

Contact: Kent Angelos

Matrix: Soil

% Solids: 63.59

ID number: M94AR022

Project: 913-1101.604

ULTS

Description:

Sampled: 11/09/94

Received: 11/21/94

Released by:

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## ANALYTICAL R

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	5.0 mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	6 mg/kg-dry		1	SWC	ICP	12/12/94
7440-50-8	Copper	4 mg/kg-dry		1	SWC	ICP	12/12/94
7439-98-7	Molybdenum	3 mg/kg-dry	ט	3	SWC	ICP	12/12/94
7440-02-0	Nickel	12 mg/kg-dry		7	SWC	ICP	12/12/94
7782-49-2	Selenium	1.4 mg/kg-dry		0.7	SWN	GFA	12/07/94
7440-22-4	Silver	0.04 mg/kg-dry		0.03	SWN	GFA	12/09/94
7440-62-2	Vanadium	15 mg/kg-dry		1	SWC	ICP	12/12/94



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ARI job number: J009 ARI Sample number: BK

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 50.56

#### RESULTS ANALYTICAL

Description:

ID number: M94AR023

Sampled: 11/09/94

Received: 11/21/94

Project: 913-1101.604

CAS Number	Analyte	Concentration	c	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	5.9 mg/kg-dry		0.8	SWN	GFA	12/08/94
7440-43-9	Cadmium	6.2 mg/kg-dry		0.4	SWC	ICP	12/12/94
7440-50-8	Copper	6.3 mg/kg-dry		0.4	SWC	ICP	12/12/94
7439-98-7	Molybdenum	1 mg/kg-dry	ט	1	SWC	ICP	12/12/94
7440-02-0	Nickel	15 mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	2.3 mg/kg-dry		0.8	SWN	GFA	12/07/94
7440-22-4	Silver	0.09 mg/kg-dry		0.03	SWN	GFA	12/12/94
7440-62-2	Vanadium	23.2 mg/kg-dry		0.4	SWC	ICP	12/12/94

1/12/95



ARI job number: J009 ARI Sample number: BL

Client: Golder

Contact: Kent Angelos

Matrix: Soil

% Solids: 49.26

ID number: M94AR024

Project: 913-1101.604

Description:

Sampled: 11/09/94 Received: 11/21/94

eleased by:

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### ANALYTICAL RESULT

CAS Number	Analyte	Concen	tration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	5.6	mg/kg-dry		0.3	SWN	GFA	12/06/94
7440-43-9	Cadmium	8.9	mg/kg-dry		0.7	SWC	ICP	12/13/94
7440-50-8	Copper	6.4	mg/kg-dry		0.7	SWC	ICP	12/13/94
7439-98-7	Molybdenum	2	mg/kg-dry	Ū	2	SWC	ICP	12/13/94
7440-02-0	Nickel	20	mg/kg-dry		4	SWC	ICP	12/13/94
7782-49-2	Selenium	1.9	mg/kg-dry		0.8	SWN	GFA	12/07/94
7440-22-4	Silver	0.08	mg/kg-dry		0.03	SWN	GFA	12/12/94
7440-62-2	Vanadium	25.2	mg/kg-dry		0.7	SWC	ICP	12/13/94

DXX 1/12/45



ARI job number: J009

Client: Golder

Matrix: Soil

% Solids: 43.18

Contact: Kent Angelos

ARI Sample number: BM

#### ANALYTICAL RESOURCES INCORPORATED

ID number: M94AR025

Project: 913-1101.604

Description:

Sampled: 11/10/94 Received: 11/21/94

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### ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	7.2 mg/kg-dry		0.8	SWN	GFA	12/08/94
7440-43-9	Cadmium	12.3 mg/kg-dry		0.4	SWC	ICP	12/12/94
7440-50-8	Copper	10.9 mg/kg-dry		0.4	SWC	ICP	12/12/94
7439-98-7	Molybdenum	1 mg/kg-dry	U	1	SWC	ICP	12/12/94
7440-02-0	Nickel	20 mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	3.2 mg/kg-dry		0.8	SWN	GFA	12/07/94
7440-22-4	Silver	0.16 mg/kg-dry		0.03	SWN	GFA	12/12/94
7440-62-2	Vanadium	38.0 mg/kg-dry		0.4	SWC	ICP	12/12/94

DXR 1/12/95



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ARI job number: J009 ARI Sample number: BN

Client: Golder

Contact: Kent Angelos

Matrix: Soil

Received: 11/21/94

% Solids: 43.26

Released by:

Description:

ID number: M94AR026

Sampled: 11/10/94

Project: 913-1101.604

#### ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	C	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	11 mg/kg-dry		1	SWN	GFA	12/08/94
7440-43-9	Cadmium	21.0 mg/kg-dry		0.4	SWC	ICP	12/12/94
7440-50-8	Copper	12.4 mg/kg-dry		0.4	SWC	ICP	12/12/94
7439-98-7	Molybdenum	1 mg/kg-dry	Ū	1	SWC	ICP	12/12/94
7440-02-0	Nickel	30 mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	4 mg/kg-dry		1	SWN	GFA	12/07/94
7440-22-4	Silver	0.24 mg/kg-dry		0.04	SWN	GFA	12/12/94
7440-62-2	Vanadium	48.6 mg/kg-dry		0.4	SWC	ICP	12/12/94

DKK 1/12/95



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ID number: M94AR027

Project: 913-1101.604

Description: Sampled: 11/10/94

Received: 11/21/94

ARI job number: J009

ARI Sample number: BO

Matrix: Soil

Contact: Kent Angelos

Client: Golder

% Solids: 34.10

ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	24 mg/kg-dry		2	SWN	GFA	12/12/94
7440-43-9	Cadmium	24.9 mg/kg-dry		0.6	SWC	ICP	12/12/94
7440-50-8	Copper	13.3 mg/kg-dry		0.6	SWC	ICP	12/12/94
7439-98-7	Molybdenum	1 mg/kg-dry	Ū	1	SWC	ICP	12/12/94
7440-02-0	Nickel	35 mg/kg-dry		3.	SWC	ICP	12/12/94
7782-49-2	Selenium	6 mg/kg-dry		1	SWN	GFA	12/07/94
7440-22-4	Silver	0.30 mg/kg-dry		0.04	SWN	GFA	12/12/94
7440-62-2	Vanadium	65.8 mg/kg-dry		0.6	SWC	ICP	12/12/94

DKR 1/12/95



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ID number: M94AR028

Project: 913-1101.604

Description:

Sampled: 11/10/94 Received: 11/21/94

(206) 621-6490 (206) 621-7523 (FAX)

% Solids: 52.99

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: BP

Released by

ANALYTICAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	M	Analyzed
7440-38-2	Arsenic	28 mg/kg-dry		2	SWN	GFA	12/12/94
7440-43-9	Cadmium	18.7 mg/kg-dry		0.4	SWC	ICP	12/12/94
7440-50-8	Copper	8.8 mg/kg-dry		0.4	SWC	ICP	12/12/94
7439-98-7	Molybdenum	0.9 mg/kg-dry	Ū	0.9	SWC	ICP	12/12/94
7440-02-0	Nickel	36 mg/kg-dry		2	SWC	ICP	12/12/94
7782-49-2	Selenium	5.3 mg/kg-dry		0.8	SWN	GFA	12/07/94
7440-22-4	Silver	0.33 mg/kg-dry		0.03	SWN	GFA	12/12/94
7440-62-2	Vanadium	39.9 mg/kg-dry		0.4	SWC	ICP	12/12/94

DKL 195



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% Solids: 47.82

Matrix: Soil

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: BQ

Project: 913-1101.604

ID number: M94AR029

Description:

Sampled: 11/10/94 Received: 11/21/94

### ANALYTICAL

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	19 mg/kg-dry		2	SWN	GFA	12/08/94
7440-43-9	Cadmium	26.2 mg/kg-dry		0.8	SWC	ICP	12/12/94
7440-50-8	Copper	8.1 mg/kg-dry		0.8	SWC	ICP	12/12/94
7439-98-7	Molybdenum	2 mg/kg-dry	ט	2	SWC	ICP	12/12/94
7440-02-0	Nickel	33 mg/kg-dry		4	SWC	ICP	12/12/94
7782-49-2	Selenium	4.3 mg/kg-dry		0.8	SWN	GFA	12/07/94
7440-22-4	Silver	0.21 mg/kg-dry		0.03	SWN	GFA	12/12/94
7440-62-2	Vanadium	44.4 mg/kg-dry		0.8	SWC	ICP	12/12/94

DKK 1/12/45



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ID number: M94AR031

Project: 913-1101.604
Description:

Sampled: 11/10/94

Received: 11/21/94

Matrix: Soil % Solids: 39.19

Client: Golder

Contact: Kent Angelos

ARI job number: J009

ARI Sample number: BR

Released by:

ANALYTICAL RESUL

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	18.2 mg/kg-dry		0.5	SWN	GFA	12/06/94
7440-43-9	Cadmium	29.5 mg/kg-dry		0.9	SWC	ICP	12/12/94
7440-50-8	Copper	10.0 mg/kg-dry		0.9	SWC	ICP	12/12/94
7439-98-7	Molybdenum	2 mg/kg-dry	ט	2	SWC	ICP	12/12/94
7440-02-0	Nickel	35 mg/kg-dry		5	SWC	ICP	12/12/94
7782-49-2	Selenium	6 mg/kg-dry		1	SWN	GFA	12/07/94
7440-22-4	Silver	0.25 mg/kg-dry		0.05	SWN	GFA	12/12/94
7440-62-2	Vanadium	57.0 mg/kg-dry		0.9	SWC	ICP	12/12/94

DKR 1/12/45



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(206) 621-6490 (206) 621-7523 (FAX)

ID number: M94SC048

Project: 913-1101.604

Description:

Sampled: 11/15/94 Received: 11/21/94

Matrix: Water

ARI job number: J009

ARI Sample number: BS

% Solids: 0.00

Client: Golder

Contact: Kent Angelos

Released by:

## ANALYTICAL RES/ULTS

CAS Number	Analyte	Concentration	C	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	0.001 mg/L	บ	0.001	RMA	GFA	12/02/94
7440-43-9	Cadmium	0.002 mg/L	ט	0.002	TWC	ICP	12/16/94
7440-50-8	Copper	0.002 mg/L	ט	0.002	TWC	ICP	12/16/94
7439-98-7	Molybdenum	0.005 mg/L	ט	0.005	TWC	ICP	12/16/94
7440-02-0	Nickel	0.01 mg/L	Ū	0.01	TWC	ICP	12/16/94
7782-49-2	Selenium	0.001 mg/L	ט	0.001	RMA	GFA	11/30/94
7440-22-4	Silver	0.0002 mg/L		0.0002	TWN	GFA	12/07/94
7440-62-2	Vanadium	0.002 mg/L	Ū	0.002	TWC	ICP	12/16/94

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DKK 1/12/95



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333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

ID number: M94SC056

Project: 913-1101.604

Description:

Sampled: 11/16/94 Received: 11/21/94

Contact: Kent Angelos Matrix: Water

Client: Golder

% Solids: 0.00

ARI job number: J009

ARI Sample number: BT

Released by:

### ANALYTICAL

CAS Number	Analyte	Concentration	C	rod	Prep	М	Analyzed
7440-38-2	Arsenic	0.001 mg/L	Ū	0.001	RMA	GFA	12/02/94
7440-43-9	Cadmium	0.002 mg/L	ט	0.002	TWC	ICP	12/16/94
7440-50-8	Copper	0.002 mg/L		0.002	TWC	ICP	12/16/94
7439-98-7	Molybdenum	0.005 mg/L	Ū	0.005	TWC	ICP	12/16/94
7440-02-0	Nickel	0.01 mg/L	ט	0.01	TWC	ICP	12/16/94
7782-49-2	Selenium	0.001 mg/L	Ū	0.001	RMA	GFA	11/30/94
7440-22-4	Silver	0.0002 mg/L		0.0002	TWN	GFA	12/07/94
7440-62-2	Vanadium	0.002 mg/L	U	0.002	TWC	ICP	12/16/94

DKK 1/12/95



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ID number: M94SC062

Project: 913-1101.604
Description:

Sampled: 11/16/94 Received: 11/21/94

Received

% Solids: 0.00 Released by:

ARI job number: J009

Client: Golder

Matrix: Water

Contact: Kent Angelos

ARI Sample number: BU

## ANALYTICAL

CAL RESULTS

CAS Number	Analyte	Concentration	С	LOD	Prep	М	Analyzed
7440-38-2	Arsenic	0.001 mg/L	U	0.001	RMA	GFA	12/02/94
7440-43-9	Cadmium	0.003 mg/L		0.002	TWC	ICP	12/16/94
7440-50-8	Copper	0.004 mg/L		0.002	TWC	ICP	12/16/94
7439-98-7	Molybdenum	0.005 mg/L	ט	0.005	TWC	ICP	12/16/94
7440-02-0	Nickel	0.01 mg/L	Ū	0.01	TWC	ICP	12/16/94
7782-49-2	Selenium	0.001 mg/L	Ū	0.001	RMA	GFA	11/30/94
7440-22-4	Silver	0.0002 mg/L	ט	0.0002	TWN	GFA	12/07/94
7440-62-2	Vanadium	0.002 mg/L	ט	0.002	TWC	ICP	12/16/94

DKR 1/12/95



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333 Ninth Ave. North Seattle, WA 98109-5157 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC001

Lab Sample ID: J009A LIMS ID: 94-19608

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

Matrix: Sediment

913-1101.603

Date Sampled: 11/11/94

Data Release Authorized: MBR Reported: 12/09/94

Date Received: 11/21/94

	Analysis		Dilution			R
Analyte	Date	Method	<u> Pactor</u>	RL	Units	Result
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.3 I
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	32.5
Total Organic Carbon @104C	11/30/94	Plumb, 1981		0.02	Percent	4.3

pH determined on 1:1 soil:D.I. water extracts.

7KR 1/12/95



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333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC002

Lab Sample ID: J009B

LIMS ID: 94-19609

Matrix: Sediment

Data Release Authorized: MWR Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/11/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.3 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	34.2
Total Organic Carbon @104C	11/30/94	Plumb,1981		0.02	Percent	4.6

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/95

RL Analytical reporting limit

U Undetected at reported detection limit



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333 Ninth Ave. North Seattle. WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC003

Lab Sample ID: J009C

LIMS ID: 94-19610

Matrix: Sediment

Data Release Authorized: W.F.

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/11/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result Q
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.3
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	35.2
Total Organic Carbon @104C	11/30/94	Plumb, 1981		0.02	Percent	5.0

pH determined on 1:1 soil:D.I. water extracts.

7XX 1/12/45

RLAnalytical reporting limit U Undetected at reported detection limit



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333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC005

Lab Sample ID: J009D

LIMS ID: 94-19611 Matrix: Sediment

Data Release Authorized: MIF
Reported: 12/09/94 12-9

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/11/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result ()
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.0
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	41.9
Total Organic Carbon @104C	11/30/94	Plumb,1981		0.02	Percent	2.8

pH determined on 1:1 soil:D.I. water extracts.

DLR 1/12/55

RL Analytical reporting limit
U Undetected at reported detection limit



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Sample No: M94SC006

Lab Sample ID: J009E

LIMS ID: 94-19612

Matrix: Sediment

Reported: 12/09/94

Data Release Authorized:

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/11/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.0 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	38.7
Total Organic Carbon @104C	11/30/94	Plumb, 1981		0.02	Percent	3.6

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/45

RLAnalytical reporting limit Undetected at reported detection limit



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Sample No: M94SC007

Lab Sample ID: J009F

LIMS ID: 94-19613 Matrix: Sediment

Data Release Authorized: Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/11/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.6
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	44.5
Total Organic Carbon @104C	11/30/94	Plumb, 1981		0.02	Percent	3.5

pH determined on 1:1 soil:D.I. water extracts.

DLR 1/12/45

RL Analytical reporting limit

Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC019

Lab Sample ID: J009G

LIMS ID: 94-19614 Matrix: Sediment

Data Release Authorized:

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/14/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.9 🛣
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	54.4
Total Organic Carbon @104C	11/30/94	Plumb, 1981		0.02	Percent	3.4

pH determined on 1:1 soil:D.I. water extracts.

DKX 1/12/95

RL Analytical reporting limit
U Undetected at reported detection limit



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333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC020

Lab Sample ID: J009H LIMS ID: 94-19615

LIMS ID: 94-19615 Matrix: Sediment

Data Release Authorized: MAP Reported: 12/09/94 QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/14/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result Q
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.0 3
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	35.8
Total Organic Carbon @104C	11/30/94	Plumb,1981		0.02	Percent	3.0

pH determined on 1:1 soil:D.I. water extracts.

7/1 K 1/12/45



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333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC021

Lab Sample ID: J009I

LIMS ID: 94-19616

Matrix: Sediment

Reported: 12/09/94

Data Release Authorized:

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/14/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.1 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	34.9
Total Organic Carbon @104C	11/30/94	Plumb,1981		0.02	Percent	4.2

pH determined on 1:1 soil:D.I. water extracts.

DXX 1/12/85

RLAnalytical reporting limit Undetected at reported detection limit



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333 Ninth Ave. North Seattle, WA 96109-5187

(206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC022

Lab Sample ID: J009J

LIMS ID: 94-19617

Matrix: Sediment Data Release Authorized: Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7 913-1101.603

Date Sampled: 11/14/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.9
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	23.6
Total Organic Carbon @104C	11/30/94	Plumb, 1981		0.02	Percent	3.8

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/95



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Seattle, WA 98109-5167 (206) 621-7523 (FAX)

333 Ninth Ave. North (206) 621-6490

Sample No: M94SC023

Lab Sample ID: J009K

LIMS ID: 94-19618 Matrix: Sediment

Data Release Authorized: MA Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/14/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.9 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	21.8
Total Organic Carbon @104C	11/30/94	Plumb, 1981		0.02	Percent	4.1

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/95

RLAnalytical reporting limit Undetected at reported detection limit



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333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC024

Lab Sample ID: J009L

LIMS ID: 94-19619

Matrix: Sediment Data Release Authorized: Mos

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/14/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.0 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	16.8
Total Organic Carbon @104C	11/30/94	Plumb, 1981		0.02	Percent	4.8

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/95

RLAnalytical reporting limit

Undetected at reported detection limit



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Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC026

Lab Sample ID: J009M

LIMS ID: 94-19620

Matrix: Sediment

Data Release Authorized: MA

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/14/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.7 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	48.8
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	2.5

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/95



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333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC027

Lab Sample ID: J009N

LIMS ID: 94-19621

Matrix: Sediment

Data Release Authorized: MAP Reported: 12/09/94 QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/14/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.1 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	58.6
Total Organic Carbon @104C	12/01/94	Plumb,1981		0.02	Percent	2.5

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/95

RL Analytical reporting limit

U Undetected at reported detection limit



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333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC028

Lab Sample ID: J0090

LIMS ID: 94-19622

Matrix: Sediment

Reported: 12/09/94

Data Release Authorized: MOF

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/14/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.6 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	58.7
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	1.9

pH determined on 1:1 soil:D.I. water extracts.

7 KK 1/12/95

RLAnalytical reporting limit U Undetected at reported detection limit



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333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-7523 (FAX)

Sample No: M94SC029

Lab Sample ID: J009P LIMS ID: 94-19623

Matrix: Sediment

Data Release Authorized: MAN Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/14/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 4
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.6 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	47.2
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	2.5

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/95

RLAnalytical reporting limit

U Undetected at reported detection limit



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Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC030

Lab Sample ID: J009Q LIMS ID: 94-19624

LIMS ID: 94-19624 Matrix: Sediment

Data Release Authorized: MAREPORTED: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/14/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result (
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.8
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	46.8
Total Organic Carbon @104C	12/01/94	Plumb,1981		0.02	Percent	2.9

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/95

RL Analytical reporting limit
U Undetected at reported detection limit



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Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC033

Lab Sample ID: J009R

LIMS ID: 94-19625 Matrix: Sediment

Data Release Authorized: MAP Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/15/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.8 I
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	15.1
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	9.4

pH determined on 1:1 soil:D.I. water extracts.

7KR 1/12/55

RLAnalytical reporting limit

Undetected at reported detection limit



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333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC034

Lab Sample ID: J009S

LIMS ID: 94-19626

Matrix: Sediment

Data Release Authorized: Mof Reported: 12/09/94 12-09 QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/15/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.1 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	14.5
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	9.0

pH determined on 1:1 soil:D.I. water extracts.

7/12/55



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333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC035

Lab Sample ID: J009T

LIMS ID: 94-19627

Matrix: Sediment
Data Release Authorized: Mor

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/15/94

Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.9
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	17.0
Total Organic Carbon @104C	12/01/94	Plumb,1981		0.02	Percent	9.0

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/1.2/45

RL Analytical reporting limit

U Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC036

Lab Sample ID: J009U

LIMS ID: 94-19628

Matrix: Sediment

Data Release Authorized: MAP
Reported: 12/09/94
12-0

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/15/94

Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result C
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.0 I
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	21.7
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	6.4

pH determined on 1:1 soil:D.I. water extracts.

DLK 1/12/95

RL Analytical reporting limit

U Undetected at reported detection limit



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Seattle, WA 98109-5187 (206) 621-6490

333 Ninth Ave. North

(206) 621-7523 (FAX)

Sample No: M94SC038

Lab Sample ID: J009V

LIMS ID: 94-19629 Matrix: Sediment

Data Release Authorized: Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/15/94 Date Received: 11/21/94

·	Analysis		Dilution			6
Analyte	Date	Method	Factor	RL	Units	Result
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.7 1
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	21.3
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	5.8
pH determined on 1:1 soil:	).I. water	extracts.			'DK	1/12/45

RLAnalytical reporting limit

Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC039

Lab Sample ID: J009W

LIMS ID: 94-19630

Reported: 12/09/94

Matrix: Sediment-Data Release Authorized: MOA QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/15/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.1 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	32.2
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	7.0

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/95

RLAnalytical reporting limit Undetected at reported detection limit



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Analytical Chemists & Consultants

Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC040

Lab Sample ID: J009X LIMS ID: 94-19631

LIMS ID: 94-19631 Matrix: Sediment

Data Release Authorized: MOV Reported: 12/09/94 QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/15/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.4 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	24.6
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	7.2

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/95

RL Analytical reporting limit

U Undetected at reported detection limit



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Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M945C041

Lab Sample ID: J009Y

LIMS ID: 94-19632 Matrix: Sediment

Data Release Authorized: MSP Reported: 12/09/94 QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/15/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.5 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	24.2
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	6.5

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/45



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333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

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Sample No: M94SC042

Lab Sample ID: J009Z

LIMS ID: 94-19633 Matrix: Sediment

Data Release Authorized: Mof. Reported: 12/09/94

129

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/15/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.4
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	30.2
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	4.3

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/55

RLAnalytical reporting limit Undetected at reported detection limit



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Sample No: M94SC044

Lab Sample ID: J009AA

LIMS ID: 94-19634 Matrix: Sediment

Data Release Authorized: MYR Reported: 12/09/94 77-9 QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/15/94
Date Received: 11/21/94

	Analysis		Dilution			P_
Analyte	Date	Method	Factor	RL	Units	Result /
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.8 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	44.9
Total Organic Carbon @104C	12/01/94	Plumb,1981		0.02	Percent	5.0

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/95

RL Analytical reporting limit

U Undetected at reported detection limit



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333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC045

Lab Sample ID: J009AB

LIMS ID: 94-19635

Matrix: Sediment

Data Release Authorized: May

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/15/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.8 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	44.9
Total Organic Carbon @104C	12/01/94	Plumb,1981		0.02	Percent	6.8

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/45

RLAnalytical reporting limit

Undetected at reported detection limit



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Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC046

Lab Sample ID: J009AC

LIMS ID: 94-19636

Matrix: Sediment
Data Release Authorized: mod

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/15/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.8
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	46.5
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	6.6

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/45

RL Analytical reporting limit

U Undetected at reported detection limit



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Analytical Chemists & Consultants



333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC049

Lab Sample ID: J009AD

LIMS ID: 94-19637 Matrix: Sediment

Data Release Authorized: MA Reported: 12/09/94 12-9

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/16/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result O
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.3 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	42.2
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	3.7

pH determined on 1:1 soil:D.I. water extracts.

7XX 1/12/95

RLAnalytical reporting limit

Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

Seattle, WA 98109-5187

333 Ninth Ave. North

(206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC050

Lab Sample ID: J009AE

LIMS ID: 94-19638 Matrix: Sediment

Data Release Authorized: MAP

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/16/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result Q
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.3 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	52.4
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	2.5

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/95

RLAnalytical reporting limit Undetected at reported detection limit U



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(206) 621-6490

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Sample No: M94SC051

Lab Sample ID: J009AF

LIMS ID: 94-19639 Matrix: Sediment

Data Release Authorized: Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7 913-1101.603

Date Sampled: 11/16/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.2
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	43.5
Total Organic Carbon @104C	12/01/94	Plumb,1981		0.02	Percent	3.5

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/95

RL Analytical reporting limit

Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5157 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC052

Lab Sample ID: J009AG

LIMS ID: 94-19640

Matrix: Sediment

Data Release Authorized: MAY Reported: 12/09/94 17-9 QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/16/94
Date Received: 11/21/94

Analyte	Analysis Date	Method_	Dilution Factor	RL	Units	Result
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.6
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	52.4
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	2.5

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/95

RL Analytical reporting limit
U Undetected at reported detection limit



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Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-7523 (FAX)

Sample No: M94SC053

Lab Sample ID: J009AH

LIMS ID: 94-19641

Matrix: Sediment

Data Release Authorized: Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/16/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.0 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	31.6
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	4.0

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/55

RL Analytical reporting limit

U Undetected at reported detection limit



**ANALYTICAL RESOURCES INCORPORATED** 

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC054

Lab Sample ID: J009AI

LIMS ID: 94-19642 Matrix: Sediment

Data Release Authorized: Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/16/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	7.0 🗹
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	32.5
Total Organic Carbon @104C	12/01/94	Plumb,1981		0.02	Percent	4.0

pH determined on 1:1 soil:D.I. water extracts.

72/95

RL Analytical reporting limit Undetected at reported detection limit



#### ANALYTICAL **RESOURCES** INCORPORATED

Analytical Chemists & Consultants



Sample No: M94SC057

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

Lab Sample ID: J009AJ LIMS ID: 94-19643

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

(206) 621-7523 (FAX)

Matrix: Sediment

913-1101.603

Date Sampled: 11/16/94 Date Received: 11/21/94

Data Release Authorized: MSF Reported: 12/09/94 12-9

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/22/94	EPA 150.1 SM 4500 H			std units	6.9
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	22.2
Total Organic Carbon @104C	12/01/94	Plumb, 1981		0.02	Percent	5.6

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/45

Analytical reporting limit RL

Undetected at reported detection limit



ANALYTICAL **RESOURCES INCORPORATED** 

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC058

Lab Sample ID: J009AK

LIMS ID: 94-19644 Matrix: Sediment

Data Release Authorized: Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/16/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result (
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	6.8 🔟
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	20.4
Total Organic Carbon @104C	12/01/94	Plumb,1981		0.02	Percent	6.7

pH determined on 1:1 soil:D.I. water extracts.

7XX 1/12/45



**ANALYTICAL** RESOURCES **INCORPORATED** 

Analytical



Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC059

Lab Sample ID: J009AL

LIMS ID: 94-19645

Matrix: Sediment

Data Release Authorized: MM Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/16/94 Date Received: 11/21/94

	Analysis		Dilution			Ø	
Analyte	Date	Method	Factor	RL	Units	Result /	
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	6.9 J	
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	24.1	
Total Organic Carbon @104C	12/01/94	Plumb,1981		0.02	Percent	5.0	

pH determined on 1:1 soil:D.I. water extracts.

7/K 1/12/95

RLAnalytical reporting limit

Undetected at reported detection limit



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Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-7523 (FAX)

Sample No: M94SC063

Lab Sample ID: J009AM

LIMS ID: 94-19646 Matrix: Sediment

Data Release Authorized:

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/16/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	6.8 -5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	24.6
Total Organic Carbon @104C	12/01/94	Plumb,1981		0.02	Percent	4.3

pH determined on 1:1 soil:D.I. water extracts.

DKF 1/12/45

Analytical reporting limit RL

Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC064

Lab Sample ID: J009AN

LIMS ID: 94-19647

Matrix: Sediment

Data Release Authorized: Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/16/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result_
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	6.7 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	10.3
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	8.0

pH determined on 1:1 soil:D.I. water extracts.

DLK 1/12/95

RLAnalytical reporting limit

Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-7523 (FAX)

Sample No: M94SC065

Lab Sample ID: J009A0

LIMS ID: 94-19648 Matrix: Sediment

Data Release Authorized:

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/16/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	6.9 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	14.6
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	9.2

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/13/95

Analytical reporting limit RLUndetected at reported detection limit



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Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-7523 (FAX)

Sample No: M94SC066

Lab Sample ID: J009AP

LIMS ID: 94-19649 Matrix: Sediment

Data Release Authorized: Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/16/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H	٠		std units	6.8 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	17.7
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	7.6

pH determined on 1:1 soil:D.I. water extracts.

7/12/95

RLAnalytical reporting limit Undetected at reported detection limit U



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Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5167 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94SC067

Lab Sample ID: J009AQ

LIMS ID: 94-19650 Matrix: Sediment

Data Release Authorized: MAR Reported: 12/09/94 12-9 QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/16/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	6.8 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	18.8
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	5.0

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/45

RL Analytical reporting limit
U Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR001

Lab Sample ID: J009AR

LIMS ID: 94-19651 Matrix: Sediment

Data Release Authorized: MAR Reported: 12/09/94 QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/06/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result_
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.4 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	41.4
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	2.9

pH determined on 1:1 soil:D.I. water extracts.

DLR 1/12/95



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Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR002

Lab Sample ID: J009AS

LIMS ID: 94-19652 Matrix: Sediment

Data Release Authorized: Not

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/07/94 Date Received: 11/21/94

	Analysis		Dilution			9_	
Analyte	Date	Method	Factor	RL	Units	Result	
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.2 5	
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	51.1	
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	2.2	

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/45



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Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR003

Lab Sample ID: J009AT

LIMS ID: 94-19653 Matrix: Sediment

Data Release Authorized: MMP Reported: 12/09/94 QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/07/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.6
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	55.6
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	2.3

pH determined on 1:1 soil:D.I. water extracts.

DXX 1/12/95

RL Analytical reporting limit
U Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR004

Lab Sample ID: J009AU

LIMS ID: 94-19654 Matrix: Sediment

Data Release Authorized:

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/07/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.7 🛣
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	59.7
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	2.7

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/45

RL Analytical reporting limit
U Undetected at reported detection limit



#### ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-7523 (FAX)

Sample No: M94AR005

Lab Sample ID: J009AV

LIMS ID: 94-19655 Matrix: Sediment .

Data Release Authorized: Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/07/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.8 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	67.4
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	2.6

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/95

RL Analytical reporting limit

Undetected at reported detection limit



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Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR006

Lab Sample ID: J009AW

LIMS ID: 94-19656 Matrix: Sediment

Data Release Authorized:

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/07/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.2
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	44.8
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	3.7

pH determined on 1:1 soil:D.I. water extracts.

DLE 1/12/95



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Analytical Chemists & Consultants

DER 1/12/95

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-7523 (FAX)

#### Sample No: M94AR007

Lab Sample ID: J009AX

LIMS ID: 94-19657 Matrix: Sediment

Data Release Authorized:

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/08/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.4
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	61.9
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	3.3

pH determined on 1:1 soil:D.I. water extracts.

RLAnalytical reporting limit Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

Seattle, WA 98109-5187 (206) 621-7523 (FAX)

333 Ninth Ave. North (206) 621-6490

Sample No: M94AR009

Lab Sample ID: J009AY

LIMS ID: 94-19658

Matrix: Sediment

Data Release Authorized: Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/08/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H		- <del></del>	std units	7.4 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	58.8
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	2.5

pH determined on 1:1 soil:D.I. water extracts.

DLR 1/12/95



ANALYTICAL RESOURCES **INCORPORATED** 

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490

(206) 621-7523 (FAX)

Sample No: M94AR011

Lab Sample ID: J009AZ

LIMS ID: 94-19659 Matrix: Sediment

Data Release Authorized: Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/08/94 Date Received: 11/21/94

	Analysis	Dilution				Ø	
Analyte	Date	Method	Factor	RL	Units	Result	
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.4 7	
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	61.2	
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	2.6	

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/95

RL Analytical reporting limit

Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-7523 (FAX)

Sample No: M94AR012

Lab Sample ID: J009BA

LIMS ID: 94-19660 Matrix: Sediment

Data Release Authorized: Mar

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/08/94
Date Received: 11/21/94

	Analysis		Dilution			Q_	
Analyte	Date	Method	Factor	RL	Units	Result	
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.4 5	
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	64.9	
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	2.2	

pH determined on 1:1 soil:D.I. water extracts.

DLR 1/12/95

RL Analytical reporting limit
U Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR013

Lab Sample ID: J009BB

LIMS ID: 94-19661 Matrix: Sediment

Data Release Authorized: MAR Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/08/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.7 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	65.6
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	2.1

pH determined on 1:1 soil:D.I. water extracts.

7/12/95



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR014

Lab Sample ID: J009BC

LIMS ID: 94-19662 Matrix: Sediment

Data Release Authorized: My 12-9

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/08/94 Date Received: 11/21/94

Analyte	Analysis Date	Method_	Dilution Factor	RL	Units	Result 9
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.6
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	54.9
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	3.0

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/45

RLAnalytical reporting limit

Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR015

Lab Sample ID: J009BD

LIMS ID: 94-19663 Matrix: Sediment

Data Release Authorized: Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/08/94 Date Received: 11/21/94

	Analysis	Dilution				Q	
Analyte	Date	Method	Factor	RL	Units	Result -	
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.4 J	
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	55.7	
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	1.9	

pH determined on 1:1 soil:D.I. water extracts.

1/12/95

RLAnalytical reporting limit U Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 95109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR016

Lab Sample ID: J009BE

LIMS ID: 94-19664

Matrix: Sediment

Data Release Authorized: Mark Reported: 12/09/94 12/9

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/08/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	67.4
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	2.5

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/95

RL Analytical reporting limit
U Undetected at reported detection limit



ANALYTICAL RESOURCES **INCORPORATED** 

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR017

Lab Sample ID: J009BF

LIMS ID: 94-19665

Data Release Authorized: Reported: 12/09/94

Matrix: Sediment

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/09/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.4
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	52.1
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	9.0

pH determined on 1:1 soil:D.I. water extracts.

TXR 1/12/95

RLAnalytical reporting limit Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-7523 (FAX)

Sample No: M94AR019

Lab Sample ID: J009BG

LIMS ID: 94-19666

Matrix: Sediment

Data Release Authorized:

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/09/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.3
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	57.9
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	3.1

pH determined on 1:1 soil:D.I. water extracts.

DLK 1/12/95

RL Analytical reporting limit
U Undetected at reported detection limit



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR020

Lab Sample ID: J009BH

LIMS ID: 94-19667

Matrix: Sediment

Data Release Authorized: MW Reported: 12/09/94

Proj

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/09/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.4
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	55.7
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	2.3

pH determined on 1:1 soil:D.I. water extracts.

DX R 1/12/95



#### **ANALYTICAL RESOURCES** INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR021

Lab Sample ID: J009BI

LIMS ID: 94-19668

Matrix: Sediment

Data Release Authorized: WMR
Reported: 12/09/94 Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/09/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.2 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	55.8
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	1.7

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/95



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR022

Lab Sample ID: J009BJ

LIMS ID: 94-19669 Matrix: Sediment

Data Release Authorized: Wil

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/09/94

Date Received: 11/21/94

	Analysis		Dilution			Q_
Analyte	Date	Method	Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.4 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	59.4
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	6.3

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/95



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Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR023

Lab Sample ID: J009BK

LIMS ID: 94-19670

Matrix: Sediment

Data Release Authorized: MAReported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/09/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.2 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	55.5
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	2.6

pH determined on 1:1 soil:D.I. water extracts.

DLR 1/12/95



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Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR024

Lab Sample ID: J009BL

LIMS ID: 94-19671

Matrix: Sediment

Data Release Authorized: MAP Reported: 12/09/94 QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/09/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.2 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	54.6
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	4.0

pH determined on 1:1 soil:D.I. water extracts.

WK 1/12/95

RL Analytical reporting limit

U Undetected at reported detection limit

Report for J009 received 11/21/94



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR025

Lab Sample ID: J009BM

LIMS ID: 94-19672

Matrix: Sediment Data Release Authorized:

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/10/94

Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.0 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	43.8
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	4.8

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/95



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR026

Lab Sample ID: J009BN

LIMS ID: 94-19673

Matrix: Sediment
Data Release Authorized:

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/10/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.2 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	42.8
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	4.0

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/95

RL Analytical reporting limit
U Undetected at reported detection limit

Report for J009 received 11/21/94



**ANALYTICAL RESOURCES INCORPORATED** 

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR027

Lab Sample ID: J009BO

LIMS ID: 94-19674 Matrix: Sediment

Data Release Authorized:

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/10/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.1 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	36.5
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	4.4

pH determined on 1:1 soil:D.I. water extracts.

DKK 1/12/95

RLAnalytical reporting limit Undetected at reported detection limit

Report for J009 received 11/21/94



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants



333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR028

Lab Sample ID: J009BP

LIMS ID: 94-19675

Matrix: Sediment

Data Release Authorized: WIR Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/10/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result G
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.1 J
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	49.9
Total Organic Carbon @104C	12/05/94	Plumb,1981		0.02	Percent	3.3

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/95



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sample No: M94AR029

Lab Sample ID: J009BQ

LIMS ID: 94-19676 Matrix: Sediment

Data Release Authorized: W

Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/10/94 Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result.
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.2 5
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	48.2
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	4.7

pH determined on 1:1 soil:D.I. water extracts.

DKR 1/12/95

RLAnalytical reporting limit Undetected at reported detection limit

Report for J009 received 11/21/94



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants



333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-7523 (FAX)

Sample No: M94AR031

Lab Sample ID: J009BR LIMS ID: 94-19677

Matrix: Sediment

Data Release Authorized: With Reported: 12/09/94

QC Report No: J009-Golder Associates

Project: Monsanto Round 7

913-1101.603

Date Sampled: 11/10/94
Date Received: 11/21/94

Analyte	Analysis Date	Method	Dilution Factor	RL	Units	Result 9
Soil pH	11/23/94	EPA 150.1 SM 4500 H			std units	7.1 1
Total Solids	11/22/94	EPA 160.3 SM 2540 B		0.01	Percent	40.2
Total Organic Carbon @104C	12/05/94	Plumb, 1981		0.02	Percent	5.0

pH determined on 1:1 soil:D.I. water extracts.

DLX 1/12/95

## ATTACHMENT 3 DATA VALIDATION SUPPORTING DOCUMENTATION

SSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSMENT SU  ASSESSM	Hov Mesta	chals, pr sample	OTHER  O  O  O  O  O  O  O  O  O  O  O  O  O
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SSESSMENT SU  AM  O  O  O  O  X  O  X  O  X	Mester Mester	sample	OTHER  O  O  O  O  O  O  O  O  O  O  O  O  O
SSESSMENT SU  AM  O  O  O  O  X  O  X  O  X	Mester Mester	sample	OTHER  O  O  O  O  O  O  O  O  O  O  O  O  O
ASSESSMENT SU  AM  B  C  C  C  C  C  C  X  C  X		CYANIDE	0 0 0 0 NA 0 0
ASSESSMENT SU  AM  B  C  C  C  C  C  C  X  C  X		CYANIDE	0 0 0 0 NA 0 0
ASSESSMENT SU  AM  B  C  C  C  C  C  C  X  C  X		CYANIDE	0 0 0 0 NA 0 0
		CYANIDE	0 0 0 0 NA 0 0
0 0 0 0 0 0 0 0 0 X	нс	CYANIDE	0 0 0 0 NA 0 0
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Acceptable

	Yes	No
1. Data package complete	eness (check if present)	
	_	
Case narrative Chain of custody	Instrument Det. Limits	
Sample Results	ICP Correction Factors ICP Linear Ranges	
ICV/CCV Results	Preparation Logs	
Blank Results	Analysis Run Logs	
ICP Interference Check Results	JOP Raw Data	
Spike Recovery Results	✓ GFAA Raw Data	
Duplicate Results LCS Results	Hg Raw Data	′/
Standard Addition Results	Other TEC pH & Solids Law date, regelt	<del>5</del> .
ICP Serial Dilution	Other 100 MA	•
Comments/Qualified Results	S:	
2. Holding times (check a	all that apply)	
	are apply	—
LICP/GFAA metals completed in <6 mos fr	om collection	
Mercury analyzed in <28 days from collect	on concount	
Cyanide completed in 14 days from collect	tion	
Comments/Qualified Results	s: Al holdon Times mit.	
, ,	The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s	
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<ol><li>Calibrations (check al</li></ol>	1 that apply) $ u$	
ICV/CCV %R for ICP/AA, 90%-110%, resu	ultu acceptable	
ICV/CCV %R for ICP/AA, 75%-89% or 11	1%-125%, results estimated (J/I.I)	
ICV/CCV %R for ICP/AA, <75% or >125	%, reject positive results (R)	
ICV/CCV %R 80-120 for Hg, results accept	etable	
ICV/CCV %R for Hg, 65%-79% or 121%-1	135%, results estimated (J/UJ)	
ICV/CCV %R for Hg. <65% or >135%, re	eject positive results (R)	
ICV/CCV %R 85-115 for Cyanide, results a ICV/CCV %R 70-84% or 116-130%, result	acceptable	
ICV/CCV %R <70% or >130%, reject por	sitive results (R)	
Comments/Qualified Desults		
Comments/Qualified Results	•	—
		<del></del>

Acceptable Yes No
4. Blanks (check all that apply)
Detects reported in ICB/CCB, list:  Detects in preparation blanks, list:  Detects in field blanks, list: M9456.056 (2.15/6-Cu) M945C062 (315/6-Cd 416/6-Ca)
Qualify as undetected (U) all sample concentrations ≤5X any associated blank concentrations.
Comments/Qualified Results: No qualification required as a result of field blank aconstruction. All sample results > 5x field blank monaentrations. Lub reported Solver detected in 2 cf 3 field blanks but ried date does not support those profive recube a Valuer corrected
5. Interference Checks (check all that apply) ICS A/B Recoveries AcceptableAI, Ca. Fe, Mg sample concentrations >ICS concentrationsICS %R 5120%, results > IDL estimated (J)ICS %R 50-79%, results > IDL estimated (UJ)ICS %R 50-79%, results > IDL estimated (UJ)ICS %R <50%, results > IDL and <idl (r="" comments="" qualified="" rejected="" results:<="" td="" ur)=""></idl>
6. Laboratory Control Samples (check all that apply)

	Acceptable Yes No
7. Duplicate (check all that apply)	<u>/</u> _
Duplicate RPD ≤20% for waters (≤35% for soils) for results >5X CRDL Duplicate range is within ±CRDL (±2xCRDL for soils) for results <5X CRDL	
Comments/Qualified Results: All duplicate APD met	Speather
Oriterial.	
8. Spike Recovery (check all that apply)	<u> </u>
Spike %R with 75-125%  Spike %R 30-74%, > 125%, results > IDL estimated (J)  Spike %R 30-74% results < IDL estimated (UJ)  Spike %R <30%, results < IDL rejected (UR)  Field blank used for spike analysis	
Comments/Qualified Results: All mutrix Spile & 1.	Thun
9. GFAA Performance	/
Duplicate injection RSD <20%  Duplicate injection RSD >20%, results > CRDL estimated (J)  Variable apike %R 85-115%  Variable Analytical spike %R 40-85%, results > IDL estimated (J)  Analytical spike %R 10-40%, results < IDL estimated (UJ)  Analytical spike %R <10%, results < IDL rejected (R)	
Comments/Qualified Results: Analytrac Spike BK But Like for Solver for following samples: M9450 034 M9450 0	1.m/s
M9450040, M9490046, M9450049 a M9450059, giler for these samples are qualified as estimate	resulte du J.

	Accepta Yes	
	/es	No
10. Other QC	<u>'</u>	
Comments/Qualified Results: Split samples of M9450006	22490	030
and M9450059 were sent to TOT-St. Laus to	Brece	lesses,
A Tobles comparing sample results is attached	Se For	The
most part, BPDs met ariterion for lahoratory dup	ice-tes	· Ne
used as a measure of No qualification of the de	ita a	Tas mode.
11. Field Duplicates	/	
Affield duplicate RPD ≤20% (≤35% for soils)		
Comments/Qualified Results: The following sample papers row	usent	4
field duplicates: 194500224 19450023 1945003	54 M44	
and 199450053 + 19450054. The Held dustrate APD to	er al	<u></u>
results met the anitoria of ± 35% or ± 2xc	KDL.	
No ficalitications of the data was necessary	<u> </u>	<del></del>
12. Result Verification		<del></del>
All results supported in raw data		
Comments/Qualified Results: All results were summer feed	Ka Y	le
saw late except the solver results repo	rtes	<u></u>
for samples may sco48 and mayscoste. The raw	anta	<u>.                                    </u>
indicated that silver was not present in 4	Kese	<del>-</del>
Two samples. Kestelts were regnalitied as to	ud ex	arco.
13. Overall Assessment	/	
Comments/Qualified Results: Data as qual/fled are	<del>.</del>	
cocy row is for ase	<del></del>	
		_
·	•	
		<del></del>
		<del></del>

#### **Sediment Samples**

M94SC001	M94SC028	M94SC046	M94SC067	M94AR016
M94SC002	M94SC029	M94SC049	M94AR001	M94AR017
M94SC003	M94SC030**	M94SC050	M94AR002	M94AR019
M94SC005	M94SC033	M94SC051	M94AR003	M94AR020
M94SC006**	M94SC034	M94SC052	M94AR004	M94AR021
M94SC007	M94SC035*2	M94SC053*3	M94AR005	M94AR022
M94SC019	M94SC036*2	M94SC054*3	M94AR006	M94AR023
M94SC020	M94SC038	M94SC057	M94AR007	M94AR024
M94SC021	M94SC039	M94SC058	M94AR009	M94AR025
M94SC022*1	M94SC040	M94SC059**	M94AR011	M94AR026
M94SC023*1	M94SC041	M94SC063	M94AR012	M94AR027
M94SC024	M94SC042	M94SC064	M94AR013	M94AR028
M94SC026	M94SC044	M94SC065	M94AR014	M94AR029
M94SC027	M94SC045	M94SC066	M94AR015	M94AR031

^{*}X Field duplicate samples.

Water Samples (All water samples are equipment blanks.)

M94SC048

M94SC056

M94SC062

^{**} A field split sample was collected and sent to TCT-St. Louis for analysis.

### Sediment/Surface Water Splits

Laboratory Sample ID	ARI M94SC006	TCT-St. Louis M94SC009	
Sumple 15	mg/kg	mg/kg	ספט
	mg/kg	mg/kg	KID
Arsenic	69	38.0 J	5\$.9 12,3 18,2
Cadmium	35.4	31.3	12,3
Copper	11	13.2	18.2
Molybdenum	2 l	J 0.1 U	J —
Nickel	43	43.6	1.4
Selenium	5	4.9	2.0 20.0
Silver	0.39	NA	20.0
Vanadium	67.1	54.9	20.0
	mg/kg*	mg/kg*	
Percent Solids	40.46	40.1	8,9
pН	7	6.52	7.1
Total Organic Carbon	36,000	54,910	41.4

Units for pH are in standard units (SU) and units for percent solids are percent.

NA = Not analyzed.

#### Sediment/Surface Water Splits

Laboratory Sample ID	ARI M94SC030	TCT-St. Louis M94SC031	
	mg/kg	mg/kg	RPD
Arsenic Cadmium	18 14.1	8.8 J 15.80	68:7
Copper Molybdenum	9.7 1 U	9.8 0.55 U	1.0
Nickel	42	35.9	15.7 39.4
Selenium Silver	11 0.1	16.4 NA	46.9
Vanadium	62.1	38.5	46.7
	mg/kg*	mg/kg*	
Percent Solids	47.65	40.8	15.5 4.7
pН	6.8	6.49	4.7
Total Organic Carbon	29,000	655,600	183-1

Units for pH are in standard units (SU) and units for percent solids are percent.

NA = Not analyzed.

#### Sediment/Surface Water Splits

Laboratory Sample ID	ARI M94SC059		TCT-St. Louis M94SC060	
	mg/kg		mg/kg	RPD
Arsenic	6.4		1.5 U	-
Cadmium	2.9		0.66 UJ	
Copper	8.4		8.2	2.4
Molybdenum	1	U	0.19 U	
Nickel	24		19.3	21.7
Selenium	3		2.3 U	41.1
Silver	0.09		NA	
Vanadium	65.7		43.3	41.1
	mg/kg*		mg/kg*	
Percent Solids	25.33		26.2	3.4 5.2
pН	6.9		6.55	5,2
Total Organic Carbon	50,000		93,000	100-1

Units for pH are in standard units (SU) and units for percent solids are percent.

NA = Not analyzed.

#### **MEMORANDUM**

TO: Monsanto Chemical Company

November 7, 1995

FR: Heidi Gregerson, Golder Associates Inc.

RE: DATA VALIDATION SUMMARY (913-1101.603)

#### INTRODUCTION

This memo presents the results of data validation on the data package prepared by Analytical Resources Incorporated. Sample information is provided in the following table.

SAMPLE ID	COMMENTS	ANALYSIS	MEDIA
M94SC009	SPLIT	INORGANICS	SEDIMENT
M94SC031	SPLIT	AND	SEDIMENT
M94SC060	SPLIT	CHEMISTRY	SEDIMENT

Attachments 1 through 3 provide the following information as indicated below:

Attachment 1. Glossary of Data Reporting Qualifiers

Attachment 2. Annotated Laboratory Reports

Attachment 3. Data Validation Supporting Documentation

#### DATA QUALITY OBJECTIVES

This section presents a summary of the data quality in terms of the referenced validation criteria.

Precision. Goals for precision were met.

Accuracy. Goals for accuracy were met, with the exception of those deficiencies listed below.

Completeness. The data package was complete for all requested analyses. A total of 3 samples were validated in this data package with a total of 30 determinations reported, all of which were deemed valid.

Holding Time. No minor deficiencies were identified based on analytical holding times requiring qualification of data.

Detection Limits. Detection limits goals were met for all sample results.

Major Deficiencies. No major deficiencies were identified which required the qualification of data as unusable.

**Minor Deficiencies.** The following minor deficiencies were identified which required the qualification of data:

#### Matrix Spike

• The matrix spike percent recovery for arsenic and cadmium were outside the control limit and associated samples were qualified. Attachments 2 and 3 provide the data qualified and supporting documentation.

#### **Blanks**

• Cadmium and molybdenum were detected in the ICB/CCB and associated samples were qualified. Attachments 2 and 3 provide the data qualified and supporting documentation.

#### Field QC

• Samples M94SC009, M94SC031, and M94SC060 were identified as splits samples of M94SC006, M94SC030, and M94SC059, respectively. Attachment 3 provides a summary of the evaluated RPDs, however, qualification is not required for field QC.

# ATTACHMENT 1 GLOSSARY OF DATA QUALIFIERS

#### Glossary of Inorganic Data Reporting Qualifiers.

- B Indicates the constituent was analyzed for and detected. The concentration reported is less than the contract required detection limit (CRDL) but greater than the instrument detection limit (IDL). The associated data should be considered usable for decision making purposes.
- U Indicates the constituent was analyzed for and not detected. The concentration reported is the sample detection limit corrected for aliquot size, dilution and percent solids (in the case of solid matrices) by the laboratory. The associated data should be considered usable for decision making purposes.
- UJ Indicates the constituent was analyzed for and not detected. Due to a minor quality control deficiency identified during data validation the concentration may not accurately reflect the sample detection limit. The associated data have been qualified as estimated but should be considered usable for decision making purposes.
- BJ Indicates the constituent was analyzed for and detected at a concentration less than the contract required detection limit (CRDL) but greater than the instrument detection limit (IDL). Due to a minor quality control deficiency identified during data validation the associated data have been qualified as estimated, but should be considered usable for decision making purposes.
- J Indicates the constituent was analyzed for and detected. Due to a minor quality control deficiency identified during data validation the associated data have been qualified as estimated, but should be considered usable for decision making purposes.
- UR Indicates the constituent was analyzed for and not detected. Due to a major quality control deficiency identified during data validation, the associated data have been qualified as unusable for decision making purposes.
- R Indicates the constituent was analyzed for and detected. Due to a major quality control deficiency identified during data validation, the associated data have been qualified as unusable for decision making purposes.

## ATTACHMENT 2 ANNOTATED LABORATORY REPORTS

#### ENVIROFORMS/INORGANIC CLP

#### 1 INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

Lab Name: TCT St. Louis

Contract: SODA SPG

Lab Code: TCT

Case No.:

SAS No.:

SDG No.: SCC_2C

Matrix (soil/water): SOIL

Lab Sample ID: 94007101

Level (low/med):

LOW

Date Received: 11/18/94

% Solids:

40.1

Concentration Units (ug/L or mg/kg dry weight): MG/KG

1			П		T	1
CAS No.	Analyte	Concentration	С	Q	М	
7429-90-5	Aluminum	<del></del> -	-		NR	
7440-36-0	Antimony		-		NR	
7440-38-2	Arsenic	38.0	-	NS-	NR F	J
7440-39-3	Barium		-		NR	
7440-41-7	Beryllium		-		NR NR P NR	ŀ
7440-43-9	Cadmium	. 31.3		N-	P	J
7440-70-2	Calcium		_		NR	
7440-47-3	Chromium		-		NR	l
7440-48-4	Cobalt		_		NR	
7440-50-8	Copper	13.2	-		NR P	
7439-89-6	Iron	-	_		NR NR	
7439-92-1	Lead		_		NR	
7439-95-4	Magnesium		_		NR	ļ
7439-96-5	Manganese		-		NR	
7439-97-6	Mercury		-	-	NR	ĺ
7440-02-0	Nickel	43.6	_		P	44.8° a4
7440-09-7	Potassium				NR	x*``
7782-49-2	Selenium	4.9		X	P	27.00
7440-22-4	Silver	0.37	Ū			, , , , , , , , , , , , , , , , , , ,
7440-23-5	Sodium				NR	
7440-28-0	Thallium		_		NR NR	
7440-62-2	Vanadium	54.9	-		P	
7440-66-6	Zinc		-		NR	
	Cyanide		-		NR	
7439-93-2	Lithium	·······	-		$\overline{NR}$	
7439-98-7	Molybdenum	0.12	힌		P	
7740-24-6	Strontium		-		NR	
· — · · · · · · · · · · · · · · · · · ·		<del></del> !	-'		انت	, .f

Color Before: BROWN

Clarity Before:

Texture: MEDIUM

Color After:

YELLOW

Clarity After: CLEAR

Artifacts: NO

Comments:

#### ENVIROFORMS/INORGANIC CLP

## INORGANIC ANALYSIS DATA SHEET

Lab Name: TCT St. Louis

Contract: SODA_SPG

SC 4C

SAMPLE NO.

Lab Code: TCT

Case No.:

SAS No.:

SDG No.: SCC 2C

Matrix (soil/water): SOIL

Lab Sample ID: 94007102

Level (low/med): LOW

Date Received: 11/18/94

% Solids:

40.8

Concentration Units (ug/L or mg/kg dry weight): MG/KG

		~ · · · · · · · · · · · · · · · · · · ·				_
CAS No.	Analyte	Concentration	С	Q	M	
7429-90-5	Aluminum		-		NR	
7440-36-0	Antimony		-		NR	
7440-38-2	Arsenic	8.8	-	N-	NR F	15
7440-39-3	Barium		-		NR	•
7440-41-7	Beryllium		-		NR	
7440-43-9	Cadmium	15.8	_	N-	NR P NR	J
7440-70-2	Calcium		-	<del></del>	NR	را
7440-47-3	Chromium		-		NR	
7440-48-4	Cobalt		-		NR	
7440-50-8	Copper	9.8	-		<b>펢펢펢미</b>	
7439-89-6	Iron		-		NR.	
7439-92-1	Lead		-		NE NE	
7439-95-4	Magnesium		-		NR NR	
7439-96-5	Manganese		-		NR	
7439-97-6	Mercury		-1		NR NR P	
7440-02-0	Nickel	35.9	-		<del>;;;</del>	
7440-09-7	Potassium	-	-		NR NR	, ,,
7782-49-2	Selenium	16.4	-	<del>x</del> —	<del>                                      </del>	it or
7440-22-4	Silver		֓֞֓֞֓֞֓֓֡֓֓֓֡֓֓֡֓֡֓֓֡֓֡֓֡֓֡֓֡֓֡֡֡	<del></del>	K P P K K P	021
7440-23-5	Sodium		<u> </u>	<del></del>	NR	
7440-28-0	Thallium		- -		NR	
7440-62-2	Vanadium	38.5	- -		<del>===</del>	
7440-66-6	Zinc		- -		NR	
	Cyanide		- -		NR NR	
7439-93-2	Lithium		- -		NR	
7439-98-7	Molybdenum	0.55	БÌ÷	<del></del> j	NR P NR	u
7740-24-6	Strontium		= -	<del></del> [	=	• •

Color Before: BROWN

Clarity Before:

Texture: MEDIUM

Color After: YELLOW

Clarity After: CLEAR

Artifacts: NO

Comments:

FORM I - IN

#### ENVIROFORMS/INORGANIC CLP

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

SCC_2C

Lab Name: TCT St. Louis

Contract: SODA SPG

Lab Code: TCT

Case No.:

SAS No.:

SDG No.: SCC_2C

Matrix (soil/water): SOIL

Lab Sample ID: 94007103

Level (low/med):

LOW

Date Received: 11/18/94

% Solids:

26.2

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	С	Q	M	
7429-90-5	Aluminum		-	<del></del>	ND	
7440-36-0	Antimony		-		崇	
7440-38-2	Arsenic	1.5	ប៊	W .	NR NR F	
7440-38-2	Barium	<del></del>	=		NR	
7440-41-7	Beryllium		-		뜲	
7440-41-7	Cadmium	0.66	B-	-N	NR P	UJ
7440-70-2	Calcium		=	<u>-1V</u>	NR	W3
			-	<del></del>		
7440-47-3	Chromium	<del></del>	_		NR VIII	
7440-48-4	Cobalt		-		NR P	
7440-50-8	Copper	8.2	_			
7439-89-6	Iron		_		NR NR	
7439-92-1	Lead		_		NR	
7439-95-4	Magnesium	**************************************	_		NR	
7439-96-5	Manganese.		_		NR	
7439-97-6	Mercury		_		NR	
7440-02-0	Nickel	19.3	_		<u>.P</u>	144
7440-09-7	Potassium				NR	<b>⊥</b> 25 −
7782-49-2	Selenium	2.3	טוט	M	P	d'aria
7440-22-4	Silver	0.57	<u></u>		지지미미지하다	•
7440-23-5	Sodium		_		NR	
7440-28-0	Thallium		-		NR	
7440-62-2	Vanadium	43.3	-		P	
7440-66-6	Zinc				NR	
	Cyanide		-		NR	
7439-93-2	Lithium		-1		NR	
7439-98-7	Molybdenum	0.19	ਹ		NR P	
7740-24-6	Strontium		-		NR	
1 - 7 - 3 - 3 - 3 - 3			_			-10

Color Before: BROWN

Clarity Before:

MEDIUM

Color After: YELLOW

Clarity After: CLEAR

Artifacts: NO

Comments:

FORM I - IN

TCT ST.LOUIS
REPORT OF ANALYSIS
FOR

MONSANTO/SODA SPRING

CLIENT ID: SC-68

CASE: 77

sog: scc-2c

PARAMETER

RESULT

۵

UNITS

METHOD COMMENTS

TOTAL ORGANIC CARBON

LAB NO.: 94007101

54910.0000 6.5200 MG/KG UNITS 9060 9045 1:10 DILUTION

DKR 1/6/45

• 17•

TCT ST.LOUIS REPORT OF ANALYSIS FOR MONSANTO/SODA SPRING

CLIENT ID: SC-4C

CASE: 77

LAB NO.: 94007102

SDG: SCC-2C

PARAMETER

1

RESULT

UNITS

METHOD COMMENTS

TOTAL ORGANIC CARBON PH

**555600.0000** 6.4900

HG/KG UNITS 9060 9045 - - -

1:10 DILUTION

7KR /4/95

TCT ST.LOUIS REPORT OF ANALYSIS FOR MONSANTO/SODA SPRING

M445C - 060 CLIENT ID: SCC-20

LAE NO.: 94007103

CASE: 77

SDG: SCC-2C

DRF 1/45

RESULT PARAMETER UNITS METHOD COMMENTS

TOTAL ORGANIC CARBON 93000.0000 MG/KG 9060 1:10 DILUTION

6.5500 UNITS 9045

## ATTACHMENT 3 DATA VALIDATION SUPPORTING DOCUMENTATION

PROJECT: Monsanto	SITE: Side Springs
LABORATORY: TOT-St. Louis	SDG: SCC-2C /M9450060
SAMPLES/MATRIX/ANALYSES: 3	Sediment 1 Water
(Water) 19450018	M945C.031
119450009	M94 SCO60
Metals Too	2 1/4

#### DATA ASSESSMENT SUMMARY

	· · · · · · · · · · · · · · · · · · ·		<del>-,···</del>		
REVIEW ITEM	ICP	AA	HG	CYANIDE	OTHER TO
1. Data completeness	0	0	• • •		0
2. Holding Times	0	0			0
3. Calibration	0	0			0
4. Blanks	C	8			0
5. ICS	0	WA			NA
6. LCS	0	0			0
7. Duplicate RPD	0	0			0
8. Spike Recovery	0	0			0
9. MSA GFAA PER!	NA	0			NA
10. Other QC	O	0			0
11. Field Duplicates	NA	NA		•	NA
12. Result Verification	0	0			0
13. Overall Assessment	0	0			0

0 = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems but do not affect data.

Comments/Qual	ified Results: <u>Para a.</u> e. These sample les sent to AR	s qualified are	asseptable
of samo	les sent to AR	s are treld splin	t simples
		1.1.	
Validated by:	Dange L. loter	Date: //6/9	5
Reviewed by:	- Work	Date: <u>950117</u>	<del></del>

			Acceptable Yes No
1. Data package completeness	(check if present	)	. 🗸 _
Case narrative Chain of custody Sample Results ICV/CCV Results Blank Results UICP Interference Check Results Spike Recovery Results Upplicate Results UCS Results Standard Addition Results ICP Serial Dilution	Instrument Det. Limits ICP Correction Factors ICP Linear Ranges I Preparation Logs I Analysis Run Logs I CP Raw Data GFAA Raw Data Hg Raw Data Cyanide Raw Data Other		
Comments/Qualified Results:		- Martinia	
2. Holding times (check all to ICP/GFAA metals completed in <6 mos from collection Mercury analyzed in <28 days from collection Cyanide completed in 14 days from collection			. 🗹 _
	All holding	trones no	et.
	,		
3. Calibrations (check all the		• • • • • • • •	
✓ICV/CCV %R for ICP/AA, 90%-110%, results accelled in ICV/CCV %R for ICP/AA, 75%-88% or 111%-125% ICV/CCV %R for ICP/AA, <75% or >125%, reject ICV/CCV %R 80-120 for Hg, results acceptable ICV/CCV %R for Hg, 65%-79% or 121%-135%, reject positive ICV/CCV %R for Hg, <65% or >135%, reject positive ICV/CCV %R 85-115 for Cysnide, results acceptable ICV/CCV %R 70-84% or 116-130%, results estimated ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130%, reject positive results ICV/CCV %R <70% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or >130% or	%, results estimated (J/UJ) t positive results (R) esults estimated (J/UJ) sitive results (R) le		
Comments/Qualified Results:	,		

Acceptable Yes No
4. Blanks (check all that apply)
Detects reported in ICB/CCB, list: Cd (Off mg/L) Arthr (negative 2010; > IDL) Ma (1.2 well)  Detects in preparation blanks, list:  Detects in field blanks, list:
Qualify as undetected (U) all sample concentrations $\leq$ 5X any associated blank concentrations.
Comments/Qualified Results: No smultication of the Ag + As results was recessary. C'd result for M945COLO was segunified as undefeated, N. Me result for M945CO31 was qualified as undefeated, N. Me result for M945CO31 was qualified as undefeated, U.
5. Interference Checks (check all that apply)  CCS A/B Recoveries Acceptable  Al, Ca, Fe, Mg sample concentrations > (CS concentrations)  ICS %R > 120%, results > IDL estimated (J)  ICS %R 50-79%, results > IDL estimated (J)  ICS %R 50-79%, results < IDL estimated (UJ)  ICS %R <50%, results > IDL and < IDL rejected (R/UR)  Comments/Qualified Results:
6. Laboratory Control Samples (check all that apply)

	Acceptable Yes No
7. Duplicate (check all that apply)	. <u>/</u> _
Duplicate RPD ≤20% for waters (≤35% for soils) for results >5X CRDLDuplicate range is within ±CRDL (±2xCRDL for soils) for results <5X CRDL	<del></del>
Comments/Qualified Results: All duphrante BPDS 11.4 Spicified privateria.	Meric
8. Spike Recovery (check all that apply)	
Spike %R with 75-125%  Spike %R 30-74%, >125%, results >IDL estimated (J)  Spike %R 30-74% results <idl %r="" (uj)="" (ur)="" <30%,="" <idl="" analysis<="" blank="" estimated="" field="" for="" rejected="" results="" spike="" td="" used=""><td></td></idl>	
Comments/Qualified Results: Spike recovery for As (145,3 Cd (58.12) outside control limits for sediment so	3°E) and
Se (4430,5%) & R cutside confrol limits for water & As and Od results for sediment samples wer	e suil Bod
as estimated, J. No spatetrantion of the courts for the surface water sample was repa	Se-
O. GFAA Performance	<u>/</u> _
Duplicate injection RSD > 20%, results > CRDL estimated (J)  Analytical spike %R 85-115%  Analytical spike %R 40-85%, results > IDL estimated (J) MSA analytical spike %R 10-40%, results < IDL estimated (UJ)  Analytical spike %R < 10%, results < IDL rejected (R)	
comments/Qualified Results: MSH analysis nompleted for	<u>m94500</u> 09,

Yes N
10. Other QC
Comments/Qualified Results: Those, Samples are 50/25 of
samples sent to ALI. Tables com revise sample
sessets are attached, for the most part the APD.
at the sample results must the arteria astablished
for Juhoranon duploutes, No chaltration of the
Course pas muse.
11. Field Duplicates
Field duplicate RPD ≤20% (≤35% for soils)
Comments/Qualified Results: No fleid day lackes of these
Sungles were Submitted.
12. Result Verification
VAll results supported in raw data
Comments/Qualified Results: All results supported in
row dita.
13. Overall Assessment
Comments/Qualified Results: Data as skalified are  acceptable for use
acces table the suos
<del></del>

Laboratory	ARI	TCT-St. Louis	
Sample ID	M94SC017	M94SC018	
	μg/L	μg/L	<u>ifD</u>
Cadmium Calcium Magnesium Selenium Sodium	0.2 90,100 63,200 1 14,600 mg/L*	U 0.4 U NA NA NA 3 U 14,800 mg/L*	<u>-</u>  1.4
pH	7.0	NA	
Conductivity	900	NA	
Hardness	480	NA	
Total Dissolved Solids	480	NA	

Units for pH are in standard units (SU) and units for conductivity are  $\mu$ mhos/cm.

Laboratory Sample ID	ARI M94SC006	TCT-St. Louis M94SC009	
	mg/kg	mg/kg	RPD
Arsenic Cadmium Copper Molybdenum Nickel Selenium Silver Vanadium	69 35.4 11 2 U 43 5 0.39 67.1	38.0 J 31.3 13.2 0.1 U 43.6 4.9 NA 54.9	59.9 12.3 18.2 1.4 2.0 20.0
	mg/kg*	mg/kg*	
Percent Solids pH Total Organic Carbon	40.46 7 36,000	40.1 6.52 54,910	8,9 7.1 41.6

Units for pH are in standard units (SU) and units for percent solids are percent.

Laboratory Sample ID	ARI M94SC030	TCT-St. Louis M94SC031	
	mg/kg	mg/kg	RPD
Arsenic Cadmium Copper Molybdenum Nickel Selenium Silver Vanadium	18 14.1 9.7 1 U 42 11 0.1 62.1	8.8 J 15.80 9.8 0.55 U 35.9 16.4 NA 38.5	68.7 11.4 1.0 15.7 39.4 46.9
	mg/kg*	mg/kg*	
Percent Solids pH Total Organic Carbon	47.65 6.8 29,000	40.8 6.49 655,600	15.5 4.7 183.1

Units for pH are in standard units (SU) and units for percent solids are percent.

Laboratory Sample ID	ARI M94SC0 <i>5</i> 9	TCT-St. Louis M94SC060	
	mg/kg	mg/kg	RPD
Arsenic Cadmium Copper Molybdenum Nickel Selenium Silver Vanadium	6.4 2.9 8.4 1 24 3 0.09 65.7	1.5 U 0.66 UJ 8.2 U 0.19 U 19.3 2.3 U NA 43.3	2.4 21.7 41.1
	mg/kg*	mg/kg*	
Percent Solids pH Total Organic Carbon	25.33 6.9 50,000	26.2 6.55 93,000	3.4 5,2 1,0,1

Units for pH are in standard units (SU) and units for percent solids are percent.

# APPENDIX H HYDROGEOLOGY

# APPENDIX H-1 WELL COMPLETION AND LITHOLOGY LOGS



LOCATION	STATE PLANE ( NORTHING		GROUND ELEVATION (feet)	WELL CONSTRUCTION DATE	HOLE DIAMETER (inches)	CASING DIAMETER (Inches)	HOLE DEPTH (feet bgs)	CASING DEPTH (feet bgs)	CASING MATERIAL	MONITORED INTERVAL (feet bgs)	FORMATION MONITORED	COMMENTS
PW-01	372453.32	656074.00	~5,986.60	ND	ND	ND	ND	ND	STEEL	open hole	UBZ,LBZ	
PW-02	371836.27	656082.36	~5,986.40	ND	ND	ND	ND	ND	STEEL	open hole	UBZ,LBZ	
PW-03	371587.10	656086.26	~5,988.60	1 2-Nov-65	24	20 16	255	100 255	STEEL	open hole	UBZ,LBZ	
PW-04	375506.05	655863.68	¯5,990.80	12-Aug-88	12 8	8	106 229	94	PVC	63 - 72 105 - 229	UBZ LBZ	
TW-01	ND	ND	ND	6-Mar-75	5	4	300	120	PVC	120 - 300	LBŽ	ABANDONED
TW-02	375493.01	655588.76	5,989.00		8 6.6	7	75 260	75	ND	open hole	UBZ,LBZ	
TW-03	369101.00	-654233.00	5,880.30	14-Aug-78	8	4	250	247	PVC	178 - 250	LBZ	ABANDONED
TW-04	⁻ 369101.00	654233.00	5,880.10	25-Aug-78	8	4	126	126	PVC	104 - 126	LBZ	ABANDONED
TW-05	⁻ 372828.00	654238.00	5,957.00	28-Aug-78	8	4	221	221	PVC	194 - 221	LBZ	ABANDONED
TW-06	~372828.00	¯654238.00	5,957.10	5-Sep-78	. 8	4	126	126	PVC	104 - 126	UBZ	ABANDONED
TW-07	369004.33	654371.73	5,884.50	5-Nov-81	10 8	4	34 60	60	PVC	40 - 60	UBZ	
TW-08	369003.99	654360.29	5,884.70	1-Nov-81	8	4	90	90	PVC	74 - 90	UBZ	
TW-09	368986.08	656682.08	5,883.90	24-Aug-84	8	4	253	251	PVC	236- 251	LBZ	
TW-10	368989.74	654367.10	5,884.40	28-Aug-84	10 8	4	21 27	24	PVC	19 - 24	UBZ	
TW-11	368986.08	656682.08	5,936.60	13-Sep-84	10 8	4	100 142	137	PVC	127 - 137	LBZ	
TW-12	369017.37	656681,35	5,937.60	14-Sep-84	10 8	4	61 102	100	PVC	84 - 102	UBZ	
TW-13	374932.31	658465.83	5,986.40	19-Sep-84	8	4	98	96	PVC	79 - 96	SLZ	
TW-14	374949.49	658474.42	5,986.50	19-Sep-84	8	4	24	21	PVC	12 - 25	SDZ	
TW-15	374947.60	658454.43	5,986.50	20-Sep-84	8	4	60	60	PVC	48 - 60	UBZ	<u> </u>
TW-16	374541.55	654567.41	5,996.90	25-Sep-84	8	4	82	77	PVC	67 - 76	UBZ	<u> </u>
TW-17	374539.37	654587.61	5,996.40	24-Sep-84	10 8	4	52 115	107	PVC	94 - 115	UBZ	
TW-18	374520.88	654587.13	5,994.60	29-Sep-84	10 8	4	77 250	234	PVC	219 - 238	LBŽ	
TW-19	368984.85	655519.33	5,891.20	1-Oct-84	8	4	30	29	PVC	23 - 30	UBZ	
TW-20	368975.43	655503.64	5,891.80	<del></del>	8	4	48	44	PVC	35 - 44	UBZ	
TW-21	368969.43	655528.89	5,891.50	8-Oct-84	8	4	130	120	PVC	105 - 122	LBZ	
TW-22	371421.14	654280.62	5,952.40	16-Oct-84	8	4	112	112	PVC	104 - 112	UBZ	
TW-23	371421.83	654265.62	5,952.40	16-Oct-84	10 B	4	88 231	186	PVC	170 - 190	LBZ	
TW-24	371435.86	654273.24	5,952.50	16-Oct-84	8	4	92	92	PVC	73 - 92	UBZ	
TW-25	⁻ 372218.00	~655264.00	5,995.80		10 8	4	105 250	191	PVC	178 - 191	LBZ	ABANDONED
TW-26	372217.87	655264.35	5,995.60	27-Oct-84	10 8	4	97 142	142	PVC	136 - 142	UBZ	

LOCATION	STATE PLANE ( NORTHING		GROUND ELEVATION (feet)	WELL CONSTRUCTION DATE	HOLE DIAMETER (Inches)	CASING DIAMETER (Inches)	HOLE DEPTH (feet bgs)	CASING DEPTH (feet bgs)	CASING MATERIAL	MONITORED INTERVAL (feet bgs)	FORMATION MONITORED	COMMENTS
TW-27	7372218.00	655264.00	5,995.60	30-Oct-84	8 .	4	98	95	PVC	88 - 95	UBZ	ABANDONED
TW-28	375486.33	654189.48	5,987.00	6-Nov-84	10 8	4	38 89	89	PVC	76 - 89	UBZ	
TW-29	375471.82	654187.34	5,987,70	2-Nov-84	10	4	47	47	PVC	40 - 47	UBZ	
TW-30	373594.42	655794.00	5,991.00	8-Nov-84	8	4	69	69	PVC	62 - 69	UBZ	
TW-31	372539.79	657709.67	5,973.90	3-Dec-84	8	4	42	30	PVC	23 - 31	UBZ	1
TW-32	372539.63	657696,82	5,974,10	13-Dec-84	8	4	190	166	PVC	151 - 181	LBZ	
TW-33	372526.92	657699.47	5,974.00	10-Dec-84	8	4	75	74	PVC	67 - 75	UBZ	1
TW-34	368993.91	655496.74	5,891.60	13-Dec-84	8	4	74	74	PVC	68 - 74	UBZ	1
TW-35	369036.29	655076.56	5,895.00	13-Feb-85	8	4	128	83	PVC	71 - 89	UBZ	
TW-36	369828.74	654892.25	5,904.70	2-Feb-85	8	4	54	54	PVC	48 - 54	UBZ	1
TW-37	372837.18	654245.63	5,957.10	13-Feb-85	8	4	102	100	PVC	93 - 100	UBZ	<u> </u>
TW-38	370446.40	656523.94	5,970.90	7-Feb-85	В	4	102	102	PVC	90 - 102	UBZ	1
TW-39	369036.99	655061.98	5,895,00	13-Feb-85	8	4	57	56	PVC	48 - 56	UBZ	1
TW-40	373122.39	655757.09	5,988.30	17-Feb-85	8	4	89	89	PVC	82 - 89	UBZ	1
TW-41	373505.54	655621.80	~5,991.50	Jul-86	8	4	68	68	PVC	55 - 68	UBZ	1
TW-42	373178.57	655840.05	~5,987.90	Jul-86	10	4	89	89	PVC	76 - 89	UBZ	
TW-43	373141.22	655697.28	~5,986.70	Jul-86	В	4	89	89	PVC	80 - 89	UBZ	
TW-44	373110.02	655768.66	~5,987.40	Jul-86	8	4	148	148	PVC	129 - 148	LBZ	
TW-45	372827.62	654238.16	5,957.30	29-May-87	10 8	4	130 230	228	PVC	214 - 228	LBZ	
TW-48	375520.55	655978.20	5,987.80	1 2-Mar-88	8	4	73	71	PVC	65 - 71	UBZ	
TW-49	374930.77	656071.52	5,995.90	1 2-Mar-88	8	4	82	82	PVC	73 - 82	UBZ	
TW-50	373849.68	656040.74	5,992.00	15-Mar-88	8	4	89	. 89	PVC	73 - 89	UBZ	
TW-51	374323.79	657503.66	⁻ 5,994.60	5-Aug-88	8	8 6	158	58 92	STEEL	37 - 51 90 - 158	UBZ LBZ	
TW-53	368055.24	654739.84	5,878.35	30-Oct-92	8	4	62	31	PVC	18 - 32	UBZ	İ
TW-54	368052.39	655240.53	5,886.70		8	4	76	50	PVC	37 - 52	UBZ	1
TW-55	368050.24	655739.76	5,884.33	21-Oct-92	8	4	69	66	PVC	52 - 67	UBZ	1
TW-56	367979.10	656276.06	5,907.70	28-Oct-92 .	8	4	106	96	PVC	85 - 98	UBZ	
TW-57	374365.91	654000.20	5,950.36	24-Oct-92	8	4	35	35	PVC	21 - 35	UBZ	1
TW-58	368980.16	655458.20	5,889.84	3-Nov-92	12	8	55	52	STEEL	37 - 52	UBZ	
HARRIS	368317.9	654651.32	⁻ 5,878.78	3-Dec-69	6	6	64	64	STEEL	58 - 62	UBZ	Ī
LEWIS	366022,93	655889.54	~5,863,35	15-Aug-74	6	5	105	105	STEEL	85 - 105	ND	T

#### NOTES:

bgs - below ground surface

MP - measuring point

ND - no data

NA - not applicable

Figure H-1

1

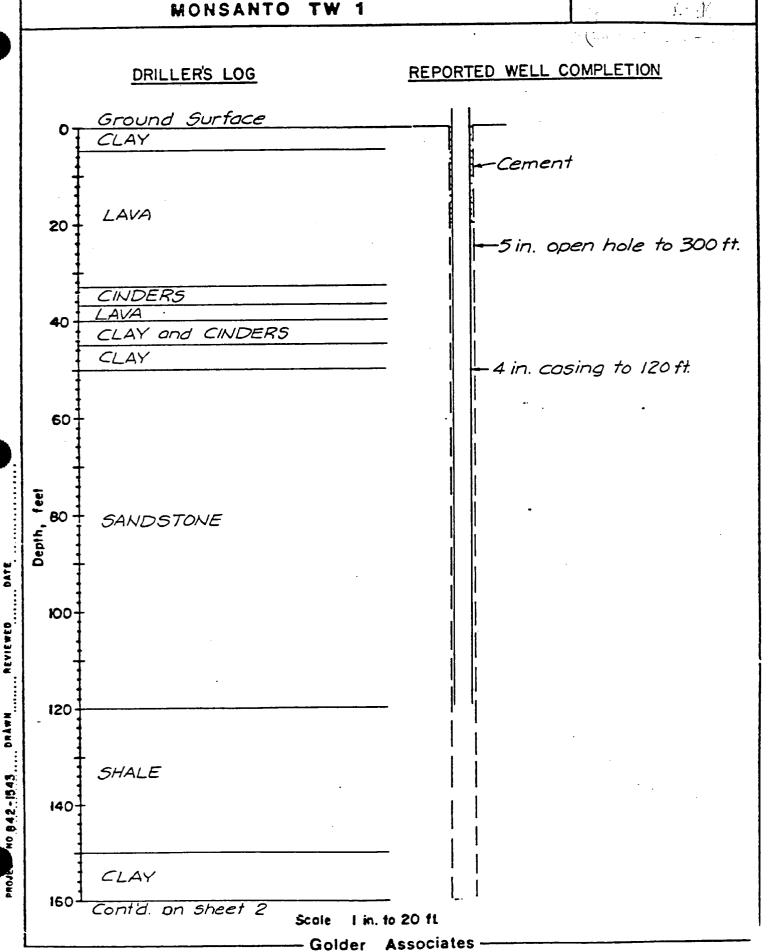


Figure T ( / A)

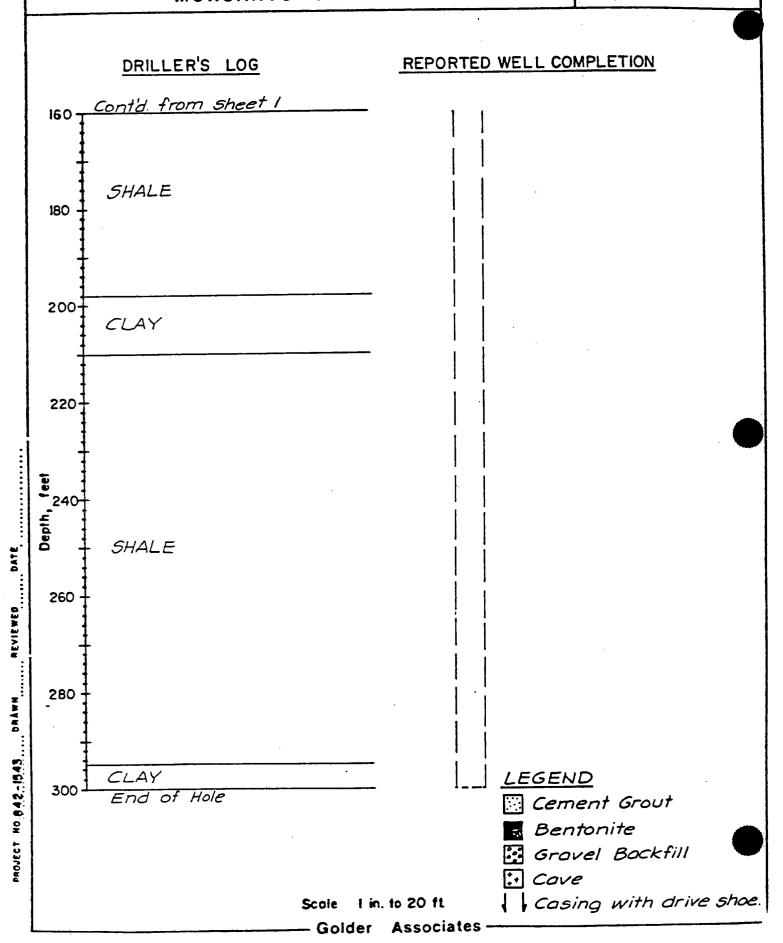


Figure H-2

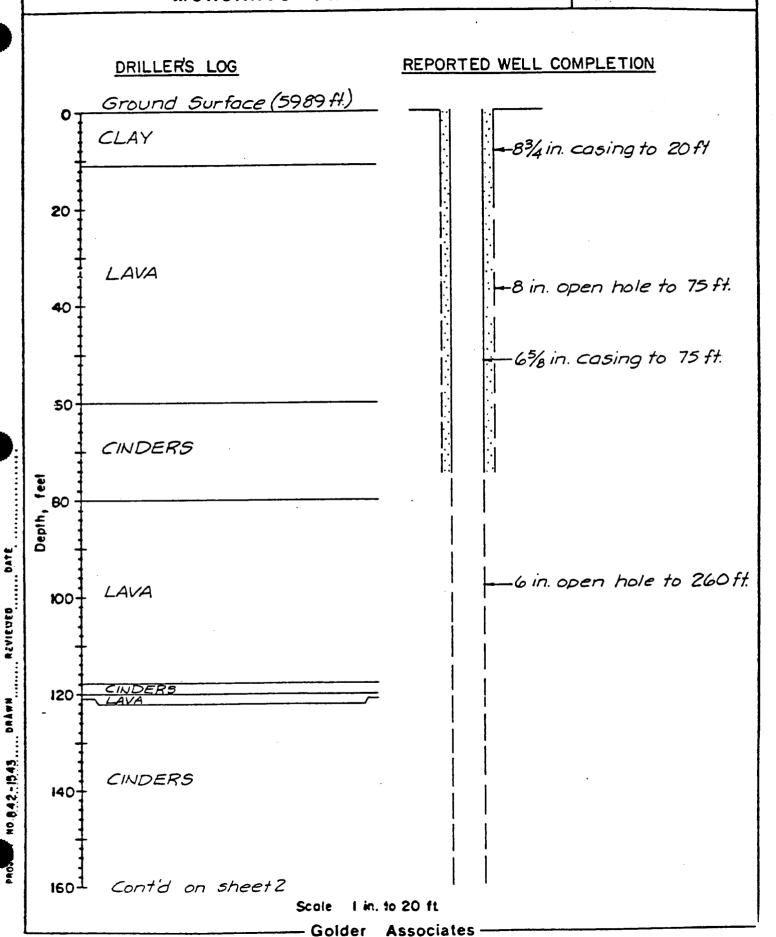
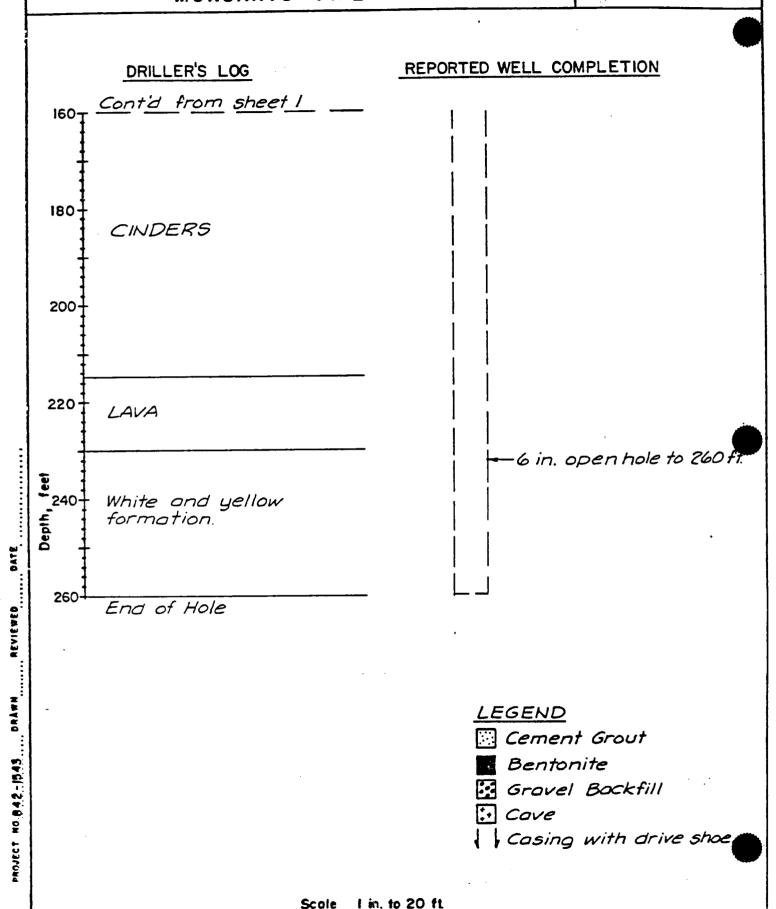


Figure 1



Golder Associates

Figure H-3

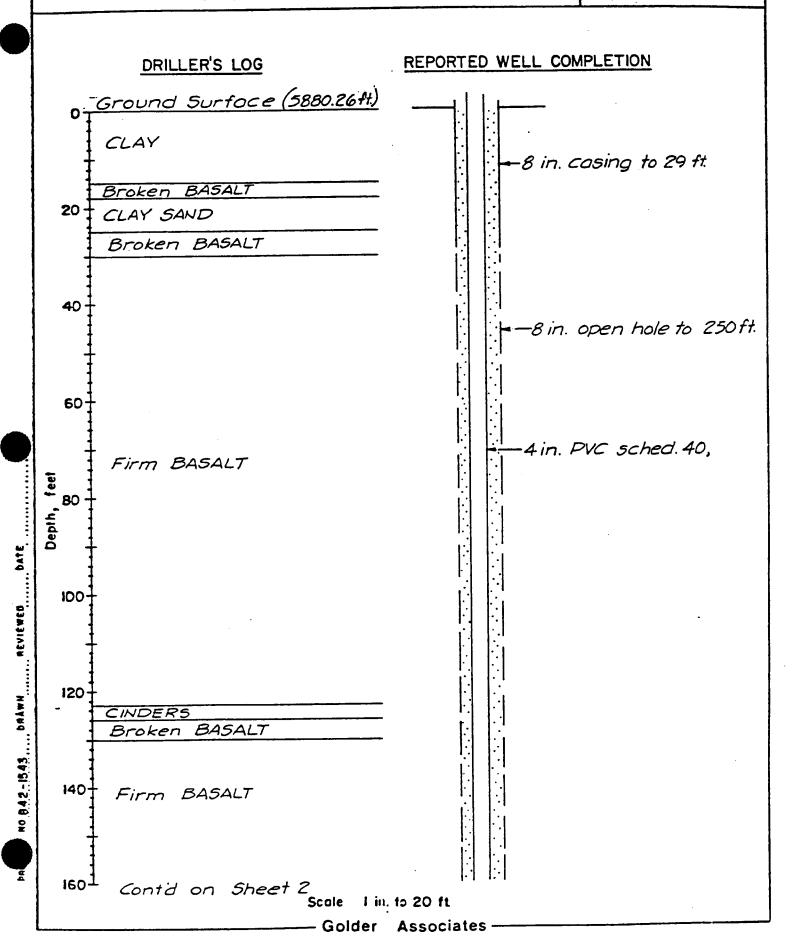
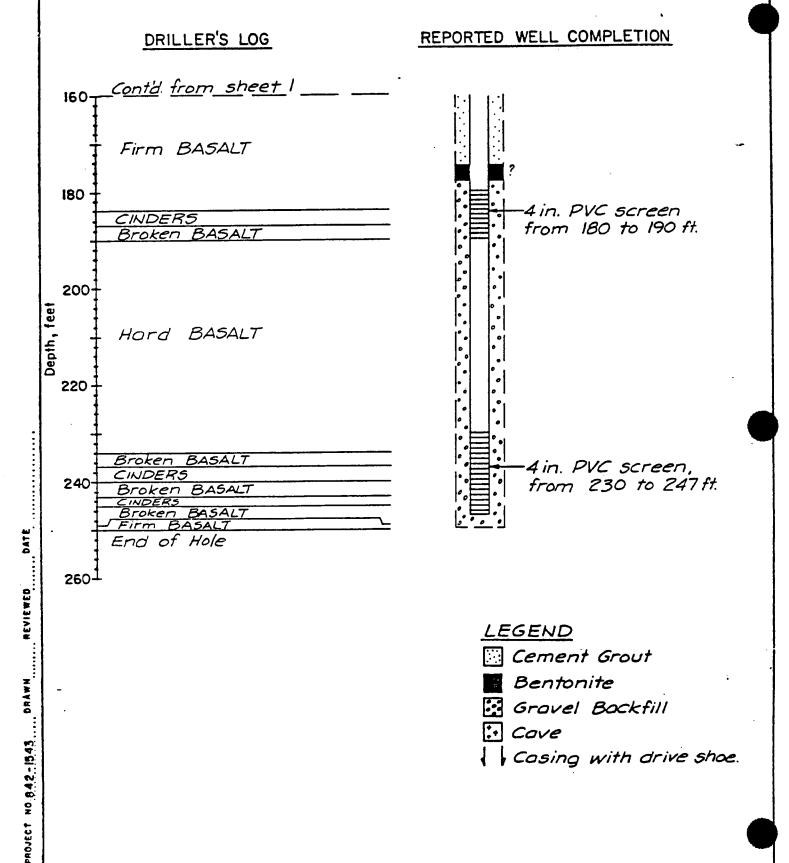


Figure 1 April



Scale 1 in. to 20 ft

Figure H-4

二儿

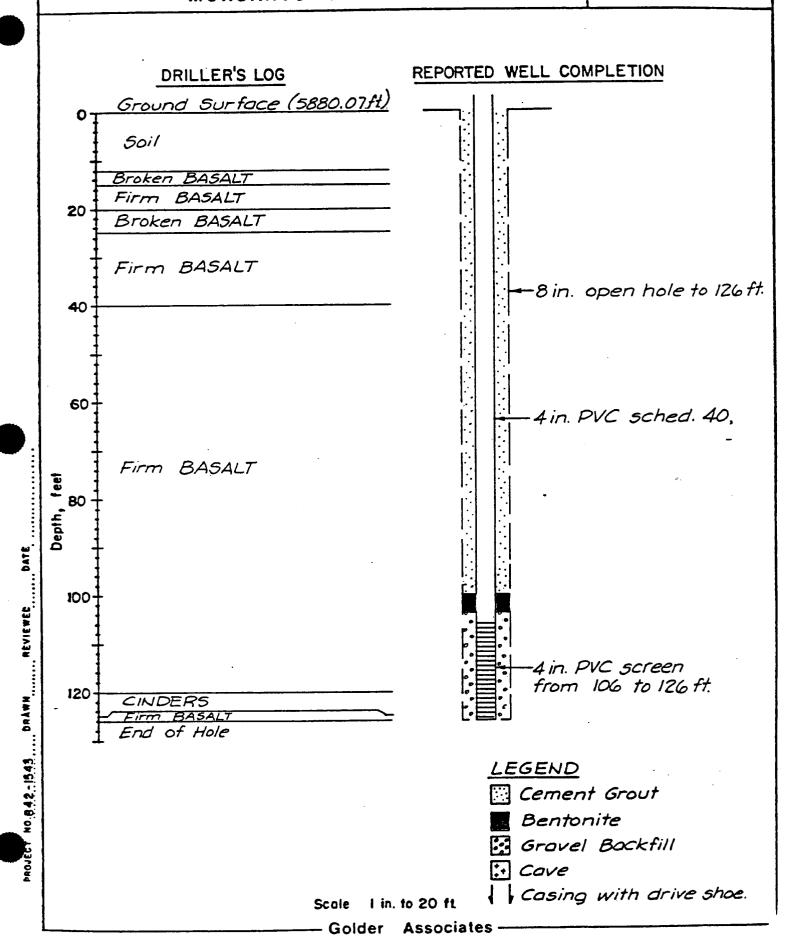


Figure H-5

T. Car

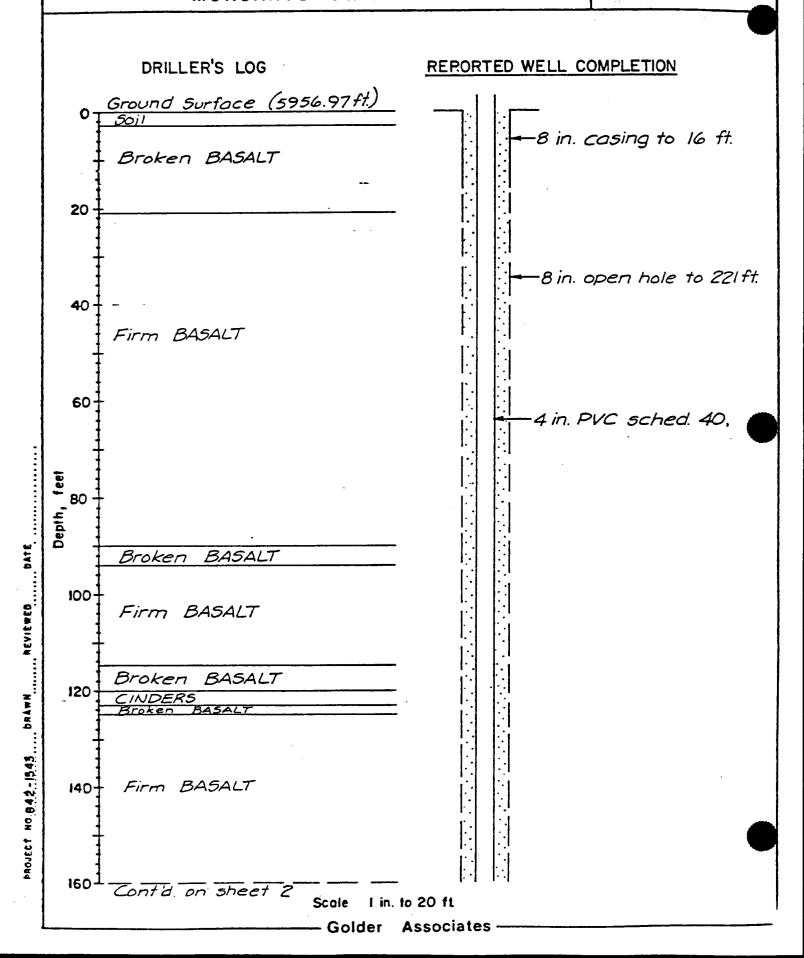
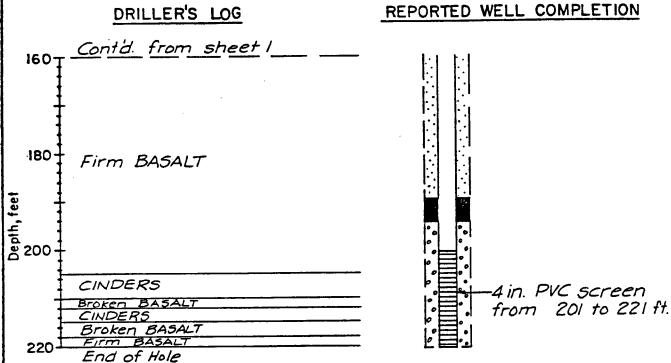
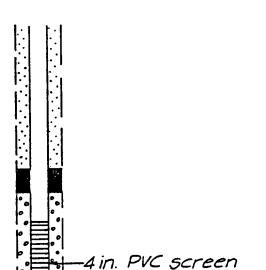


Figure 6.5





#### LEGEND

- Cement Grout
- **Bentonite**
- Gravel Bockfill
- : Cave
  - Casing with drive shoe.

NO.842-1543 DAAWN

Scale I in. to 20 ft

Figure H-6

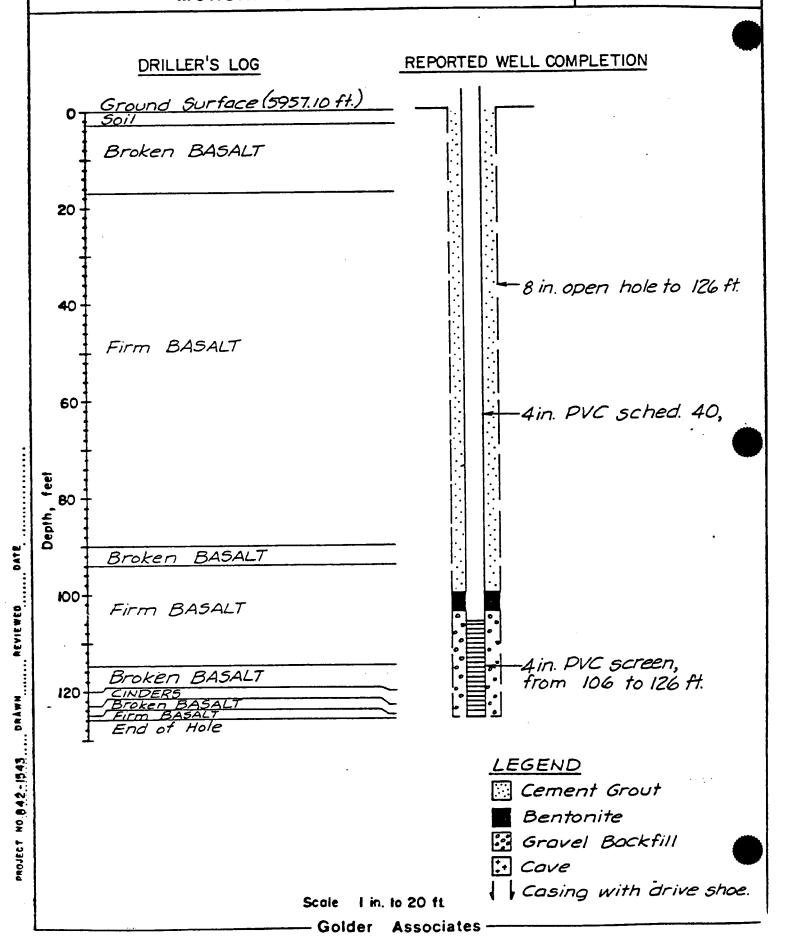
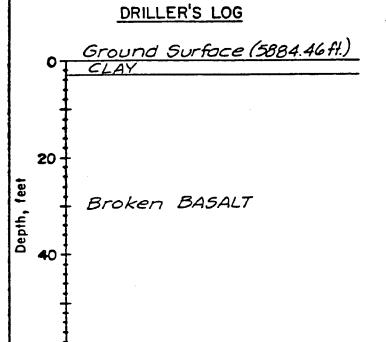
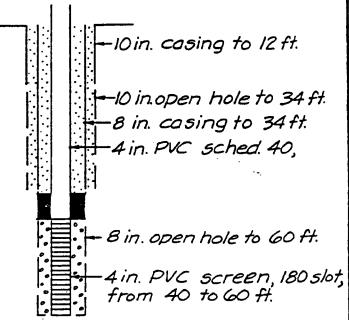


Figure H-7



### REPORTED WELL COMPLETION



#### LEGEND

- Cement Grout
- **Bentonite**
- Grovel Bockfill
- : Cove
  - Casing with drive shoe.

Scale 1 in. to 20 ft

- Golder Associates

60

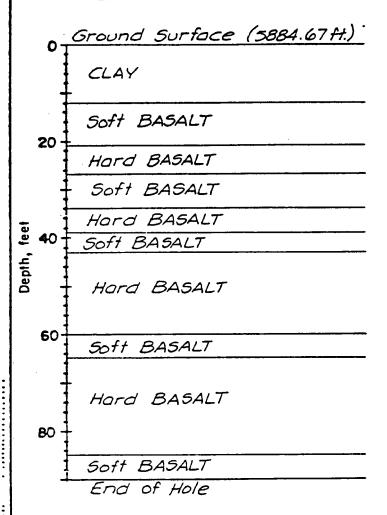
End of Hole

**Figure** 

H-8



#### REPORTED WELL COMPLETION



←8 in. casing to 20.8 ft.

←8 in. open hole to 95 ft.

4 in. PVC sched. 40,

4 in. PVC screen, 180 slot, from 75 to 90 ft.

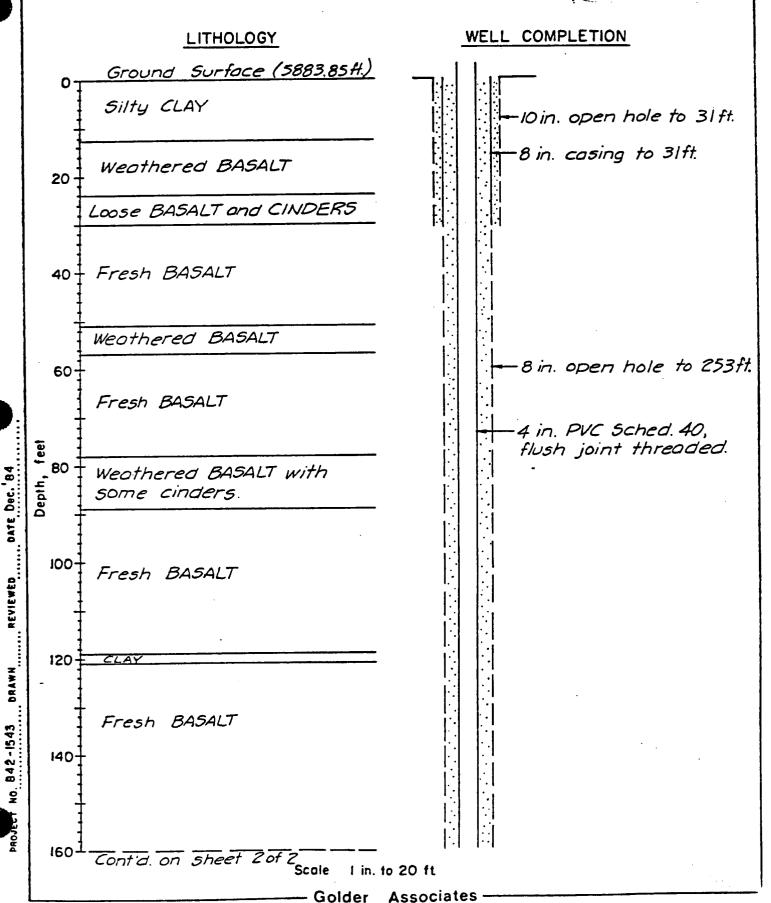
#### LEGEND

- Cement Grout
- Bentonite
- Gravel Backfill
- Cave
  Casing with drive shoe.

Scale 1 in. to 20 ft

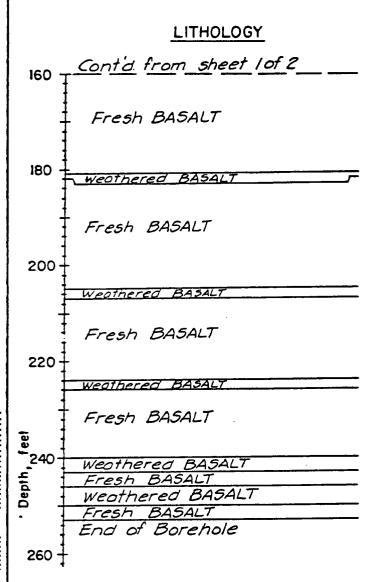
Figure H-9

Sheet 1 of 2



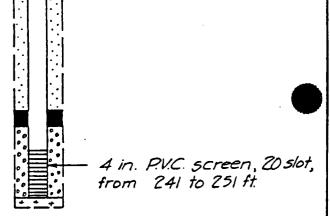
Figure

(Sheet Z of 2)



PROJECT NO. 842-1543 DRAWN





#### LEGEND

Cement Grout

**Bentonite** 

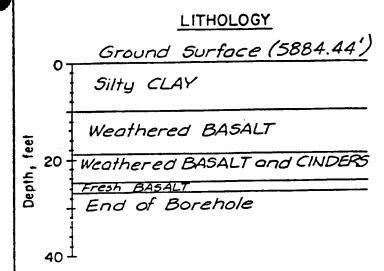
Grovel Bockfill

∷ Cave

Casing with drive shoe.

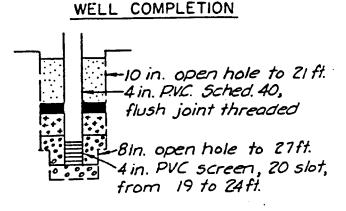
Scale I in. to 20 ft

Figure H-10



REVIEWED

NO 842-1543 DRAWN



#### LEGEND

- Cement Grout
- **B**entonite
- Grovel Bockfill
- : Cove
- Casing with drive shoe.

Scale 1 in. to 20 ft

Figure H-11

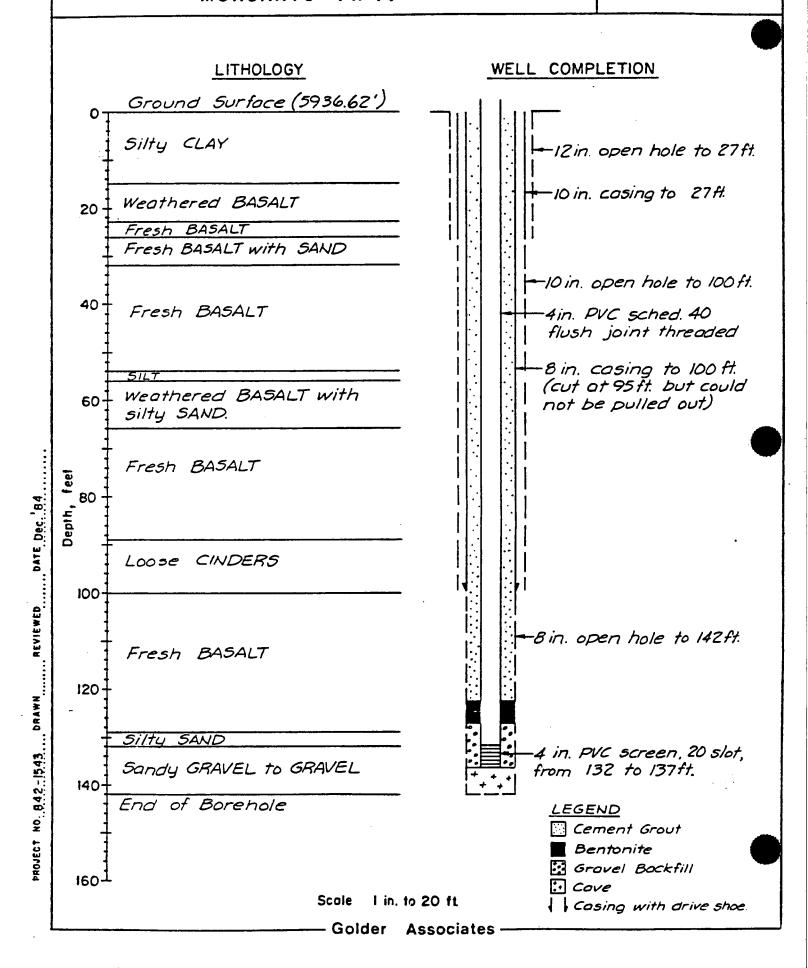


Figure H-12

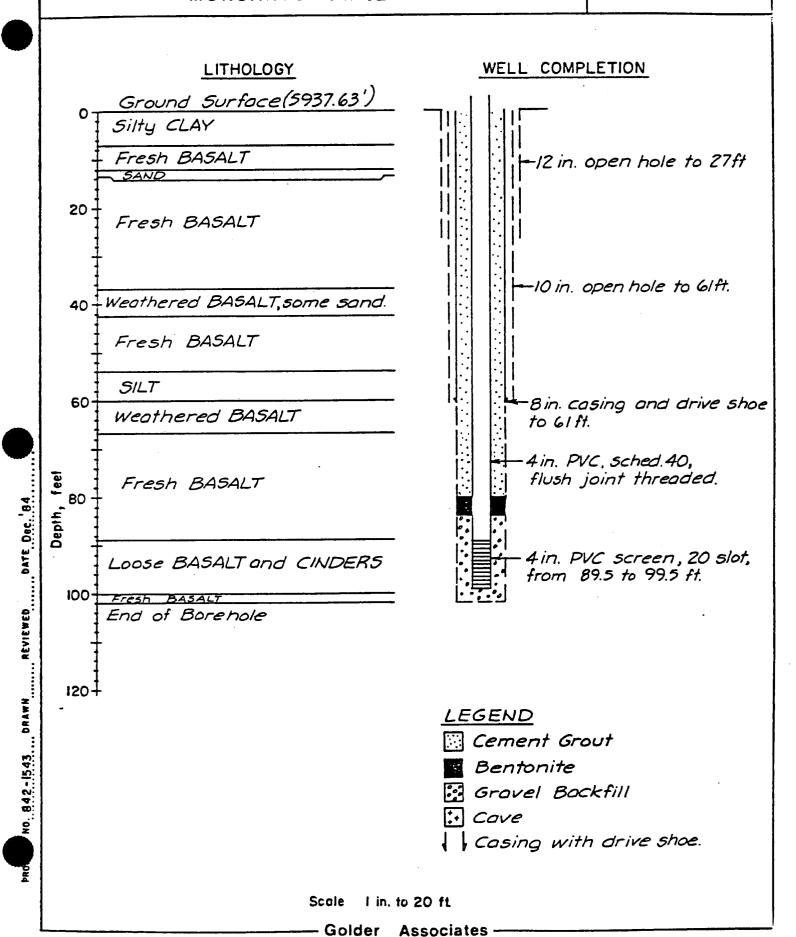
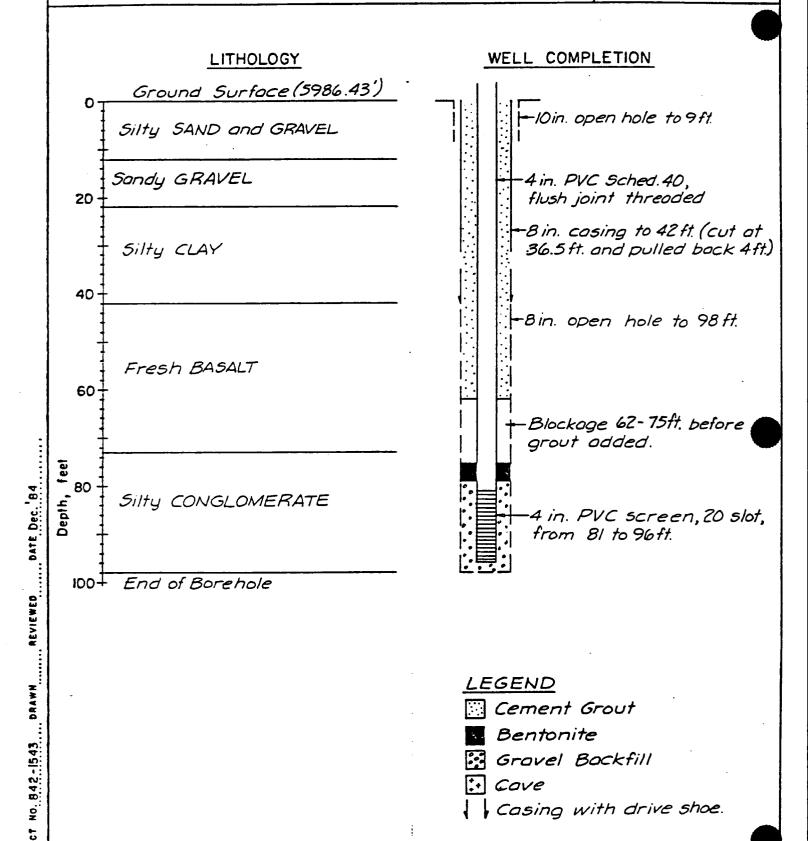
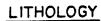


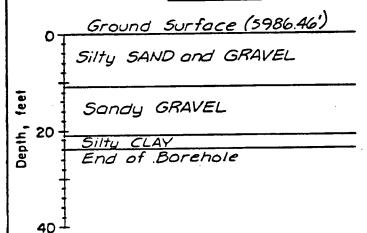
Figure H-13



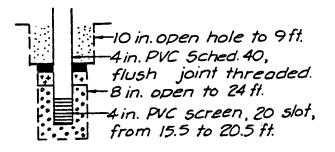
Scale I in. to 20 ft

Figure H-14





#### WELL COMPLETION

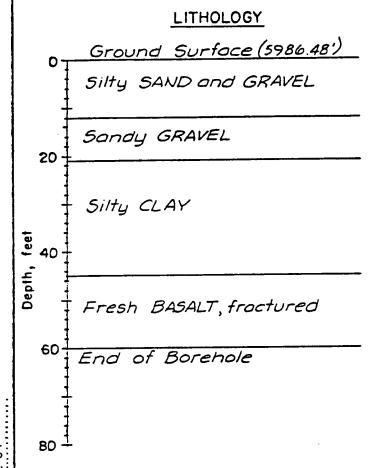


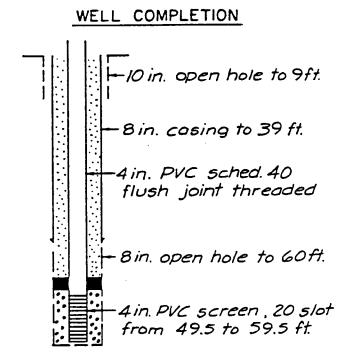
#### LEGEND

- Cement Grout
- Bentonite
- Grovel Bockfill
- : Cove
  - Casing with drive shoe.

Scale 1 in. to 20 ft

Figure H-15





#### LEGEND

Cement Grout

**Bentonite** 

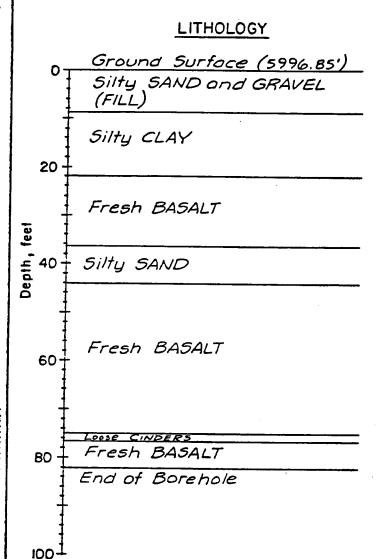
Grovel Bockfill

: Cove

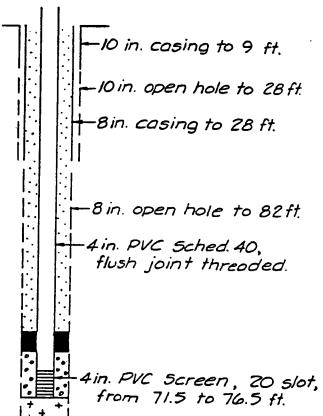
Casing with drive shoe.

Scale I in. to 20 ft.

Figure H-16



#### WELL COMPLETION

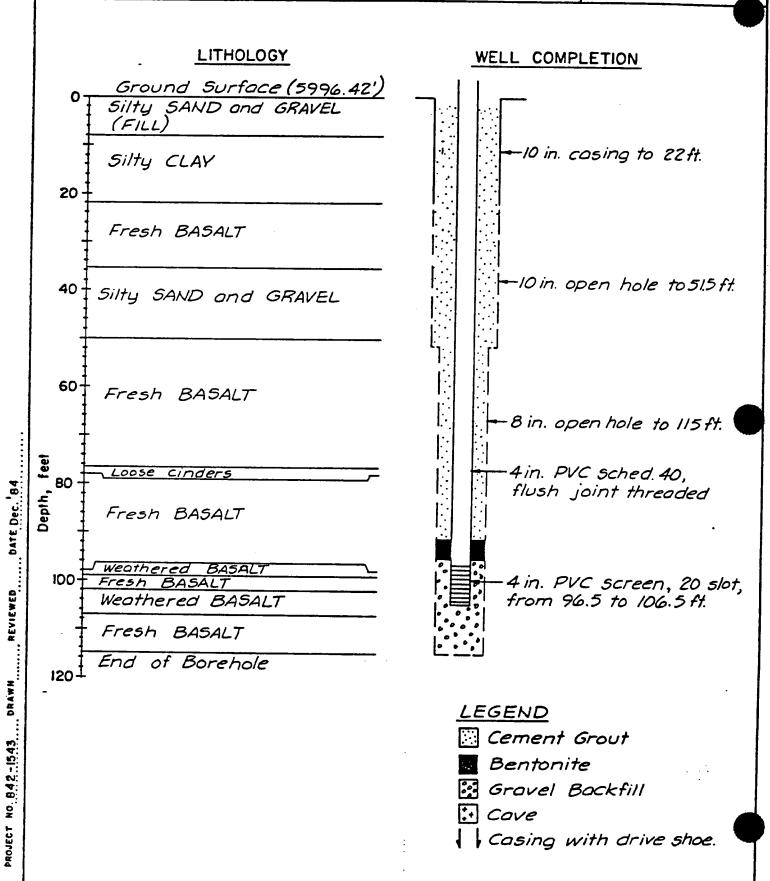


#### LEGEND

- Cement Grout
- **Bentonite**
- Gravel Backfill
- : Cove
  - Casing with drive shoe.

Scale 1 in. to 20 ft

Figure H-17

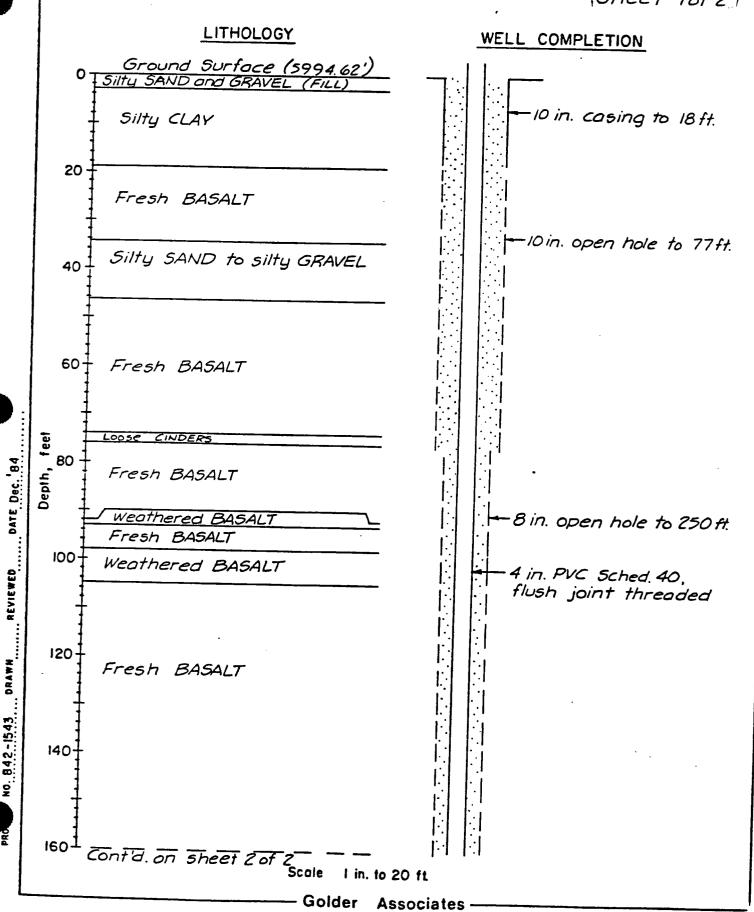


Scale 1 in. to 20 ft

Figure

H-18

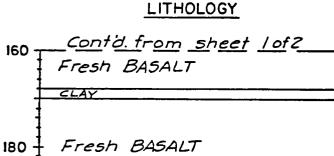
Sheet lof 21



NO. 842-1543 DRAWN

Figure

Sheet 2 of 2



Weothered BASALT

Fresh BASALT

200 Depth, feet

End of Borehole

Weathered BASALT 240 Fresh BASALT

#### WELL COMPLETION

4 in. PVC screen, 20 slot from 224 to 234

#### LEGEND

Cement Grout

Bentonite

Grovel Bockfill

: Cave

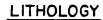
Casing with drive shoe.

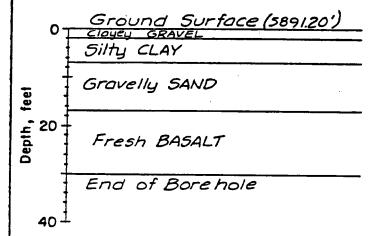
Scale 1 in. to 20 ft

– Golder – Associates –

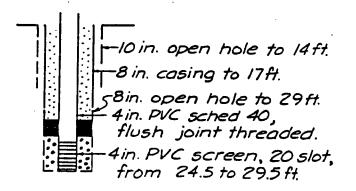
260 1

Figure H-19





#### WELL COMPLETION

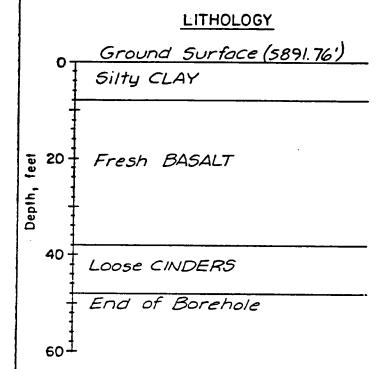


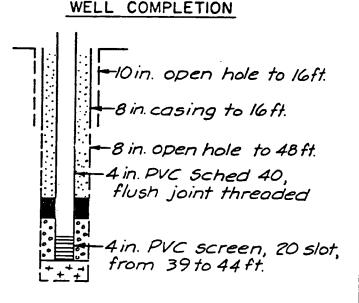
#### LEGEND

- Cement Grout
- **Bentonite**
- Grovel Bockfill
- : Cove
- Casing with drive shoe.

Scale 1 in. to 20 ft

Figure H-20





#### LEGEND

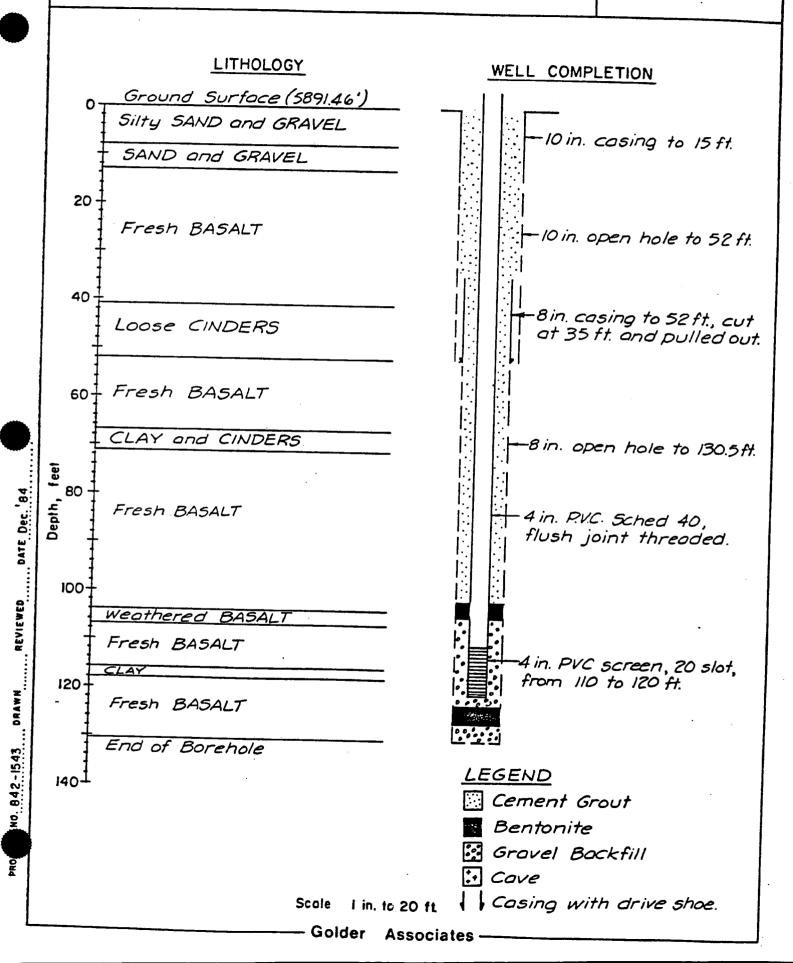
- Cement Grout
- **Bentonite**
- 🔀 Grovel Bockfill
- : Cove
- Casing with drive shoe.

Scale 1 in. to 20 ft

- Golder Associates -

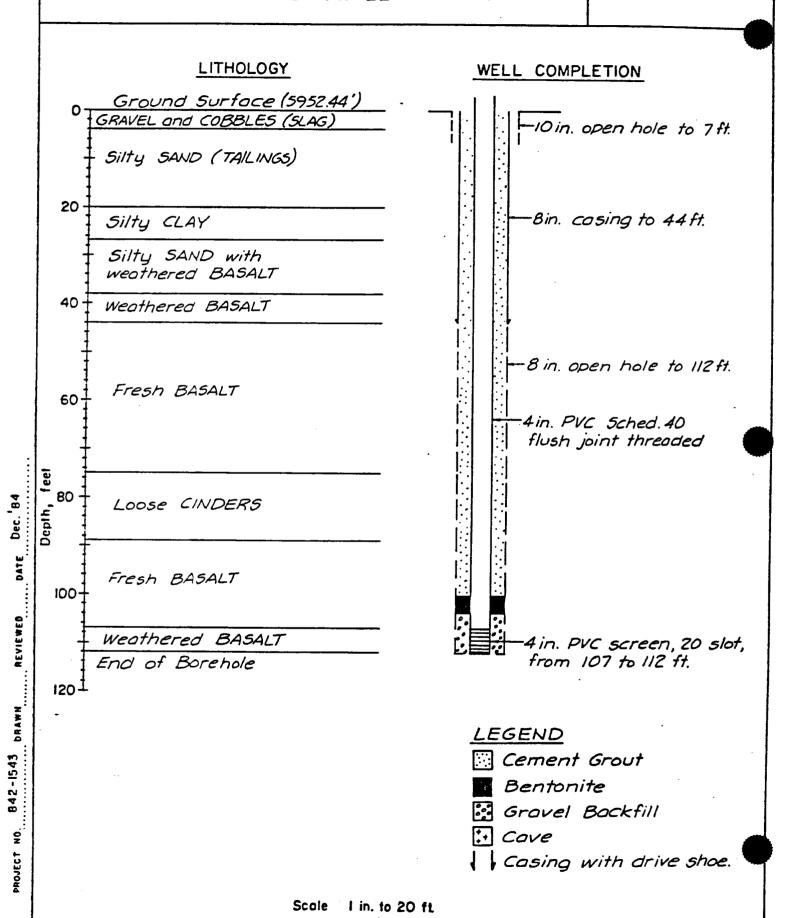
REVIEWED

Figure H-21

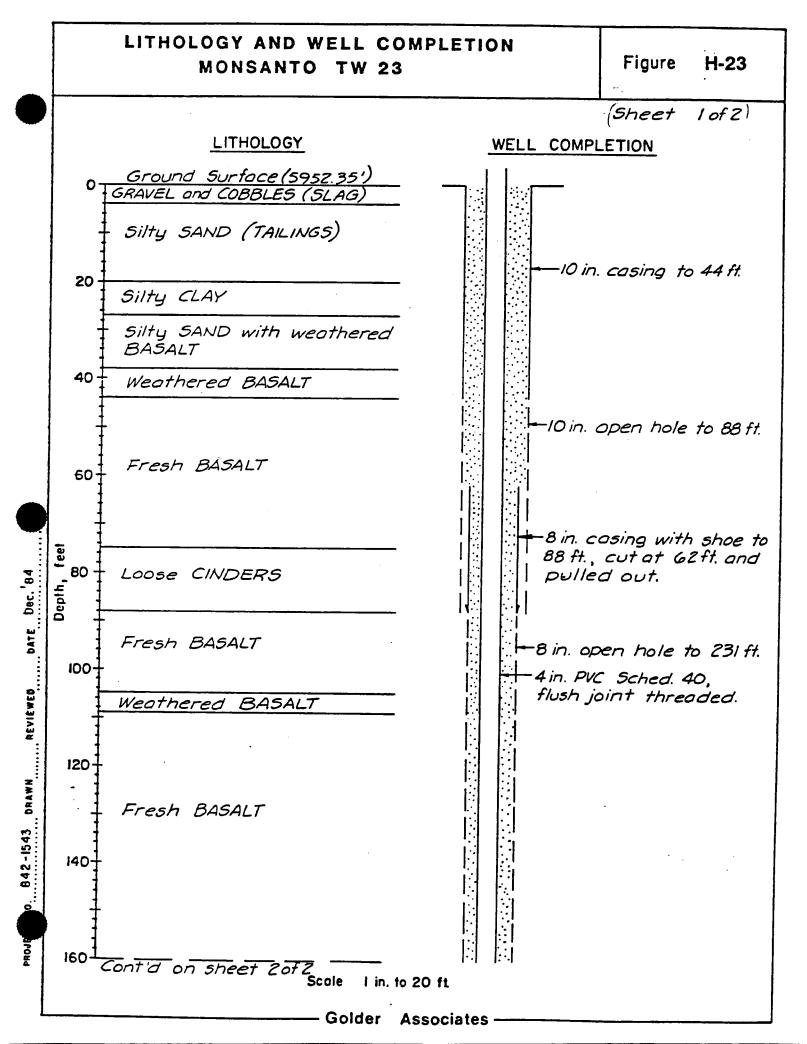


Figure

H-22



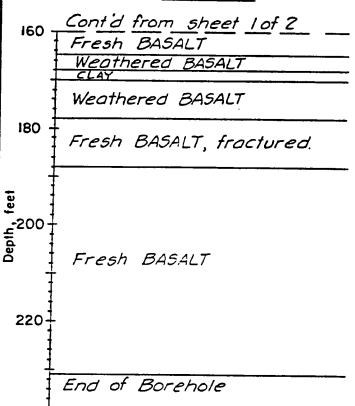
- Golder Associates -



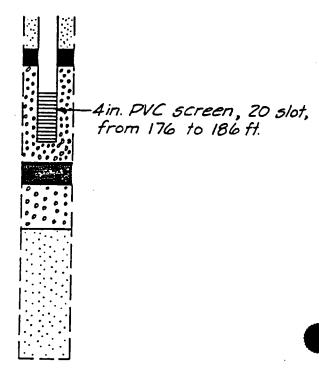
**Figure** 

(Sheet 2 of 2)





#### WELL COMPLETION



#### LEGEND

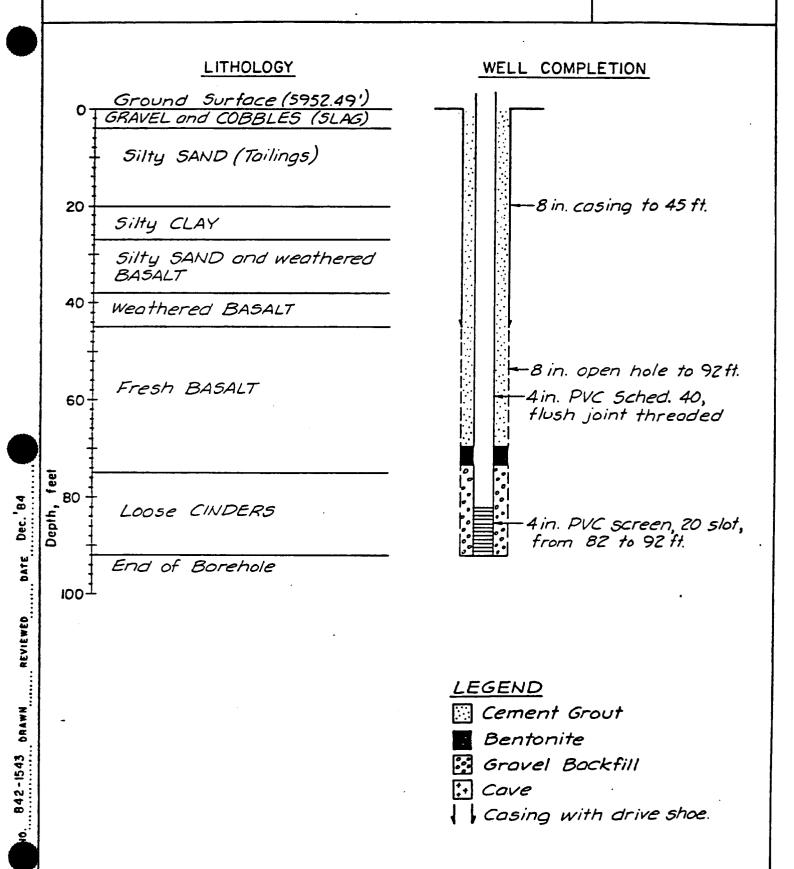
- 🔯 Cement Grout
- **Bentonite**
- Gravel Backfill
- : Cove
  - Casing with drive shoe.

Scale | I in. to 20 ft

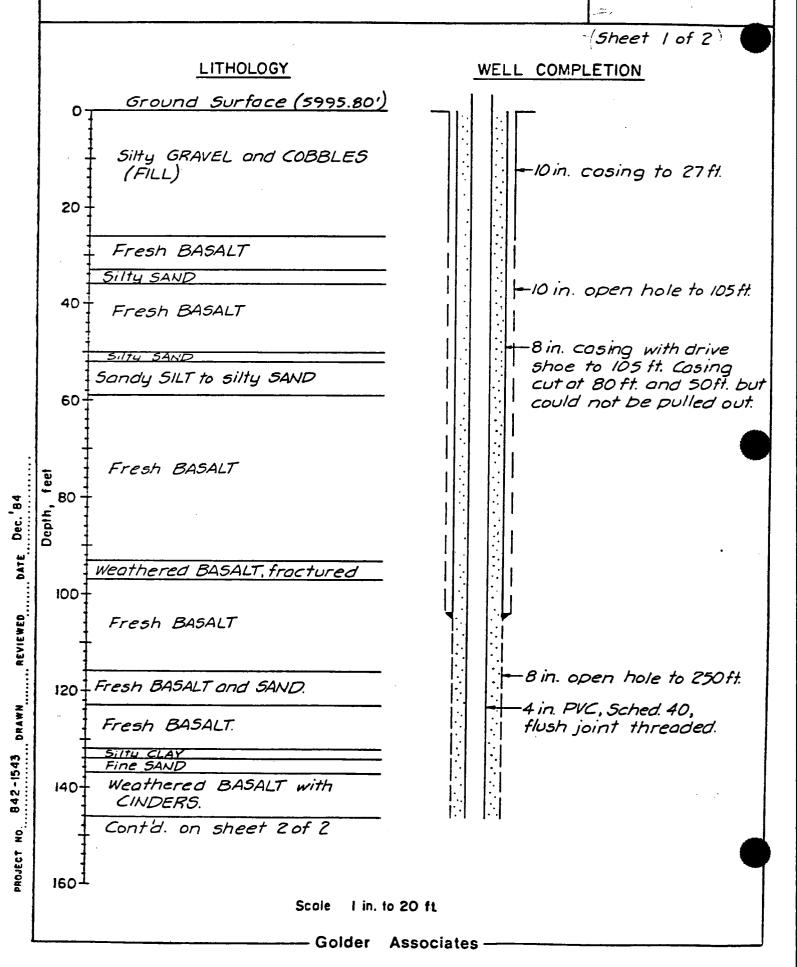
- Golder Associates -

240-

Figure H-24

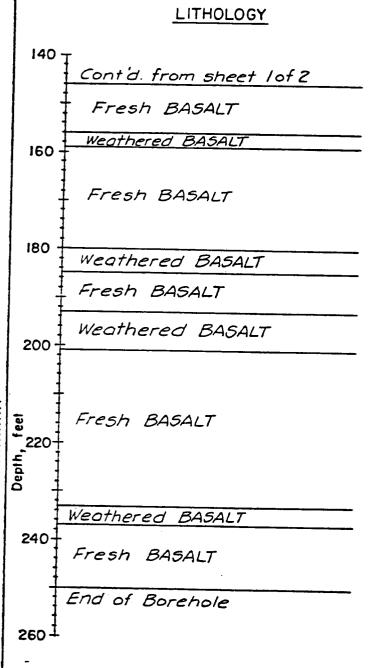


Scale 1 in. to 20 ft

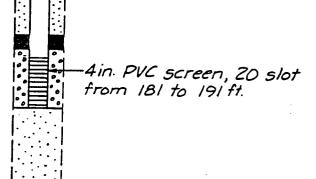


Figure

Sheet Zof Zi



#### WELL COMPLETION

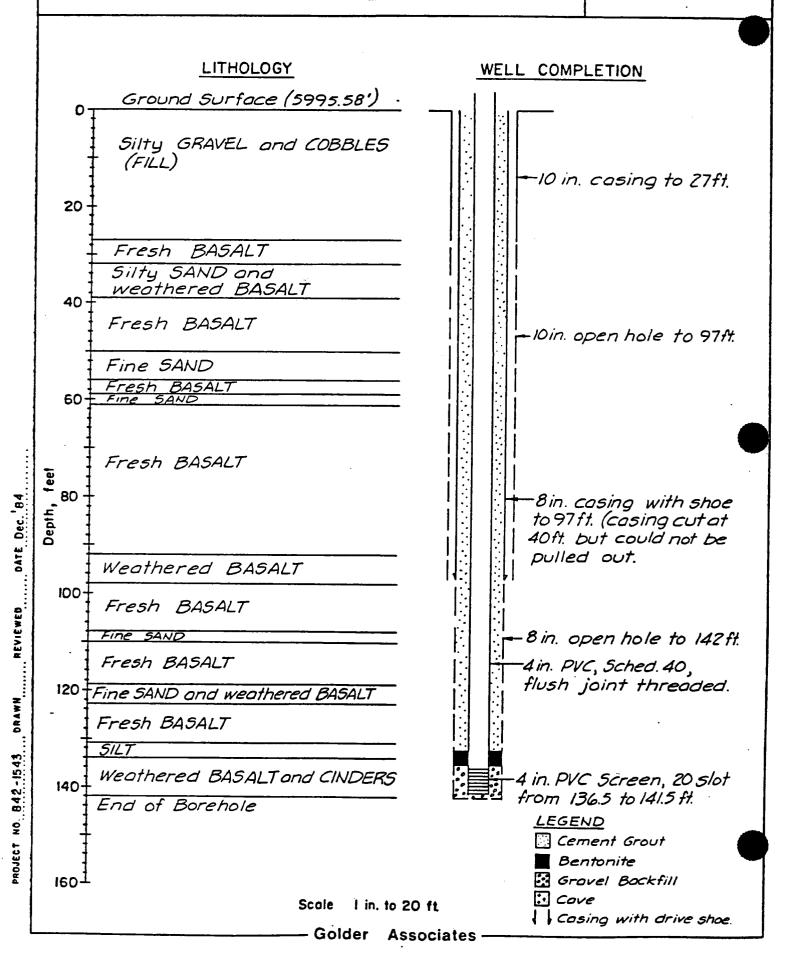


#### LEGEND

- Cement Grout
- Bentonite
- Grovel Bockfill
- ∷ Cove
  - Casing with drive shoe.

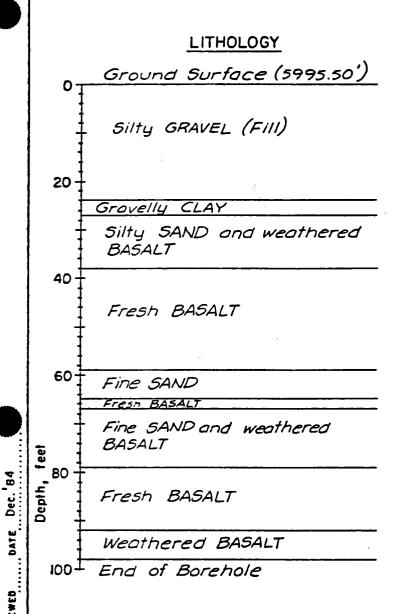
Scale 1 in. to 20 ft

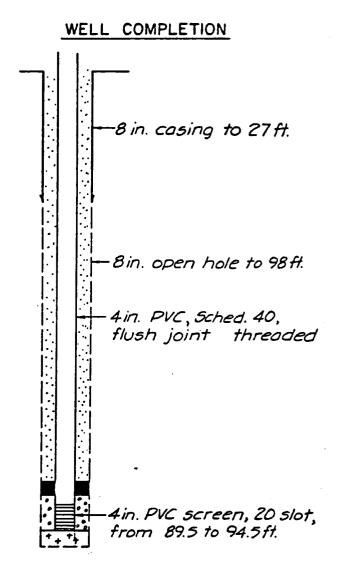
- Golder Associates –



Figure

H-27





#### LEGEND

Cement Grout

**Bentonite** 

📆 Gravel Bockfill

: Cave

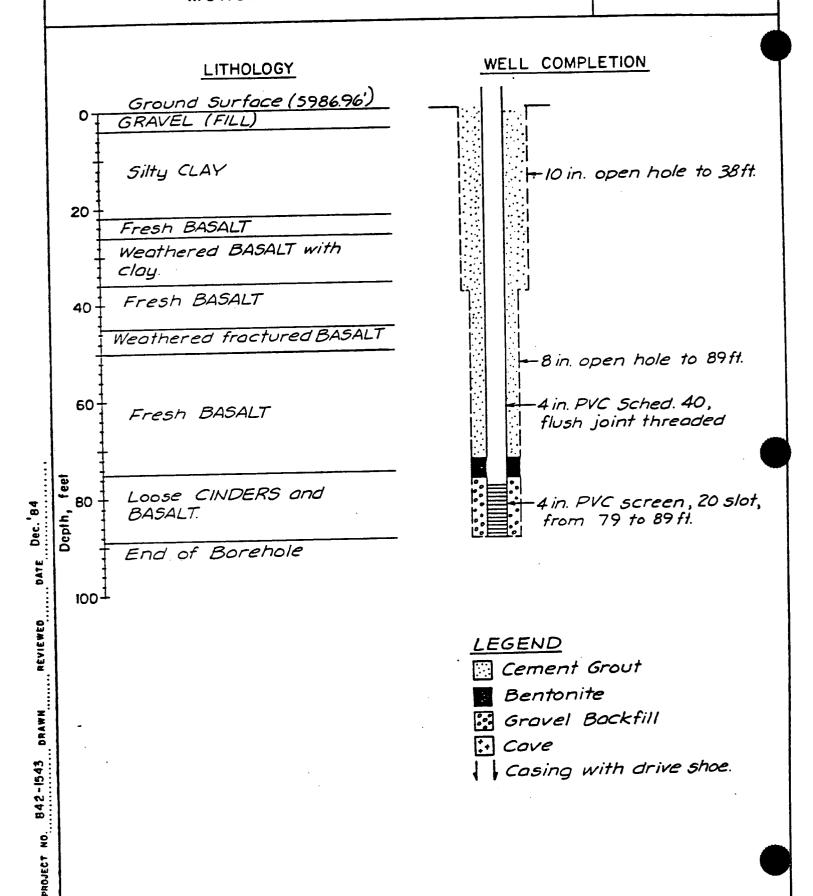
Casing with drive shoe.

Scale I in. to 20 ft

– Golder Associates –

Figure

H-28

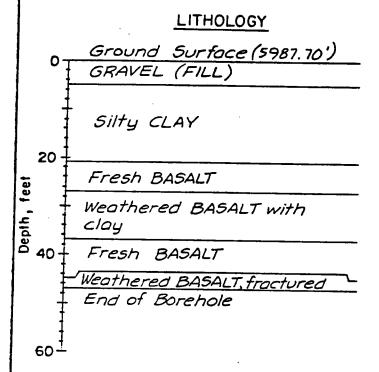


Scale 1 in. to 20 ft

Golder Associates -

Figure

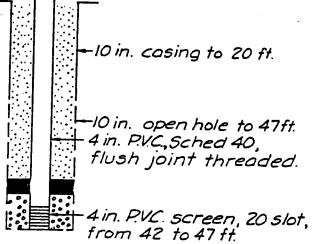
H-29



DRAWN

842-1543

# WELL COMPLETION



#### LEGEND

Cement Grout

**Bentonite** 

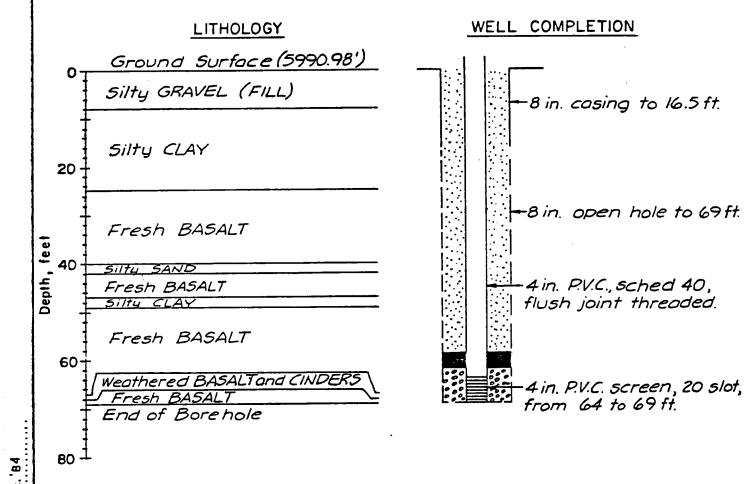
🔀 Gravel Bockfill

: Cave

Casing with drive shoe.

Scale 1 in. to 20 ft

Figure H-30



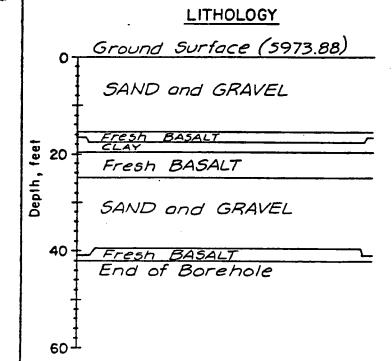
#### LEGEND

- Cement Grout
- **Bentonite**
- Grovel Bockfill
- Cove
- Casing with drive shoe.

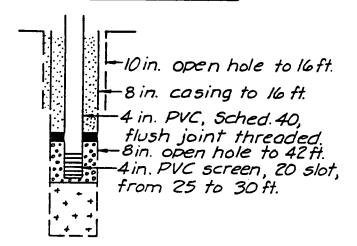
Scale | in. to 20 ft

PROJECT NO. 842-1543 BRAWN REVIEWED DATE

Figure H-31



#### WELL COMPLETION



#### LEGEND

- Cement Grout
- **Bentonite**
- 🔀 Grovel Bockfill
- : Cove
- Casing with drive shoe.

Scale I in. to 20 ft

Golder Associates -

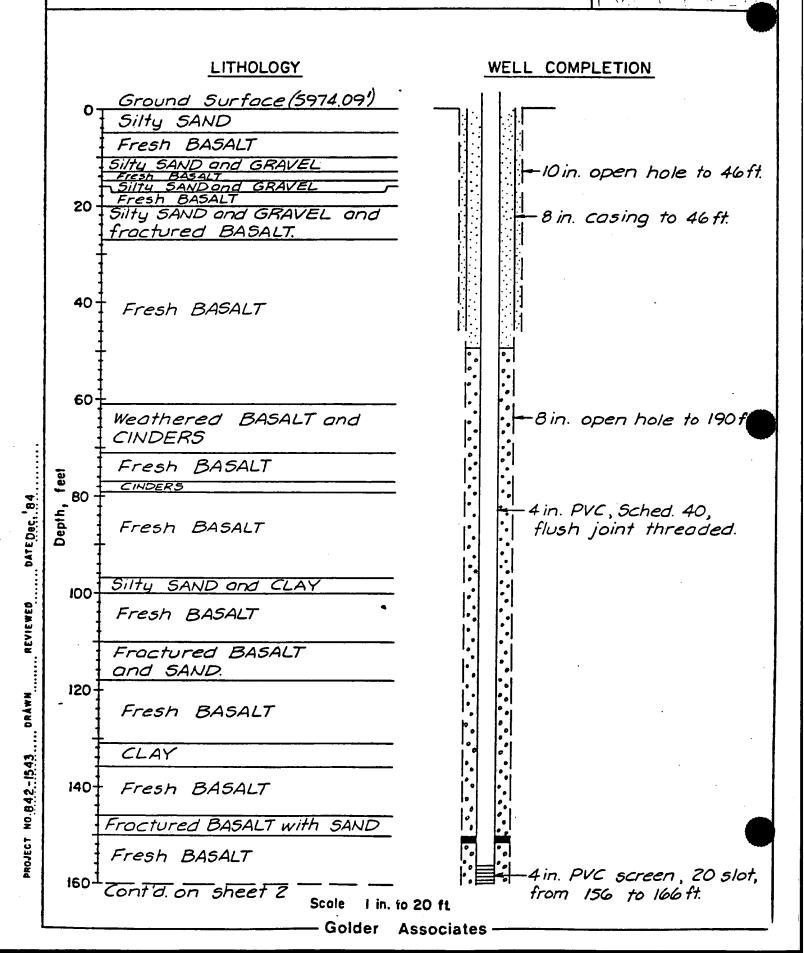
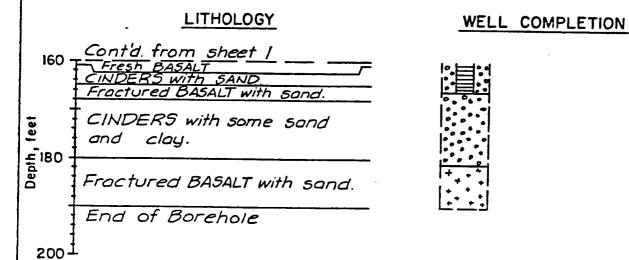


Figure 4



#### LEGEND

- Cement Grout
- **Bentonite**
- 🔀 Gravel Bockfill
- : Cove

REVIEWED

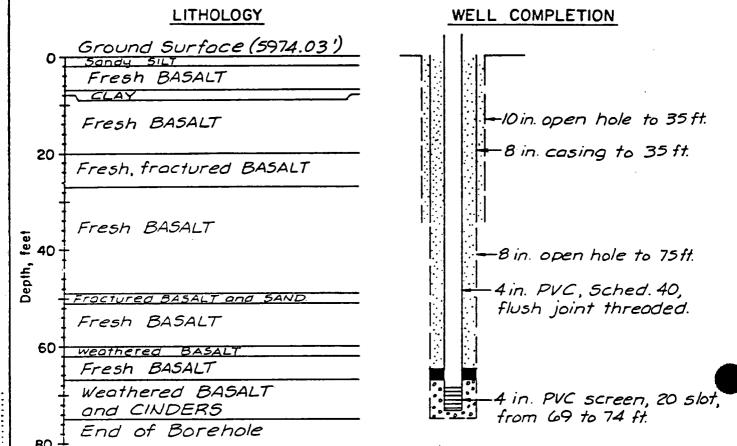
NO.842-1543 DRAWN

Casing with drive shoe.

Scale 1 in. to 20 ft

- Golder Associates

Figure H-33



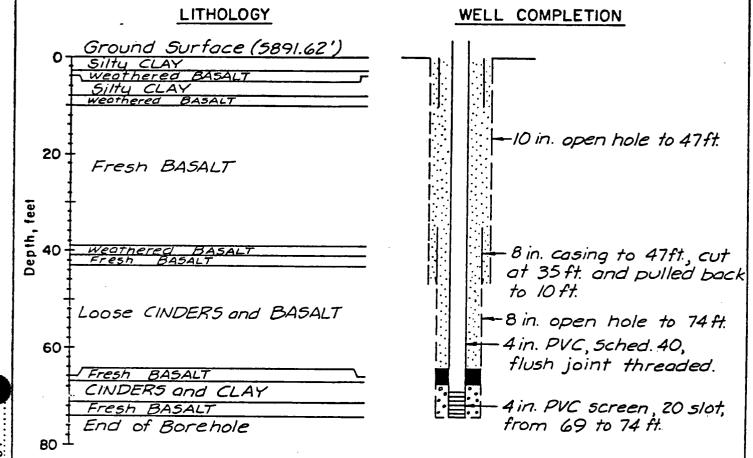
#### LEGEND

- Cement Grout
- **Bentonite**
- Grovel Bockfill
- : Cove
  - Casing with drive shoe.

Scale I in. to 20 ft

- Golder Associates -

Figure H-34



#### LEGEND

Cement Grout

Bentonite

Gravel Bockfill

: Cove

Casing with drive shoe.

Scale 1 in. to 20 ft

Golder Associates

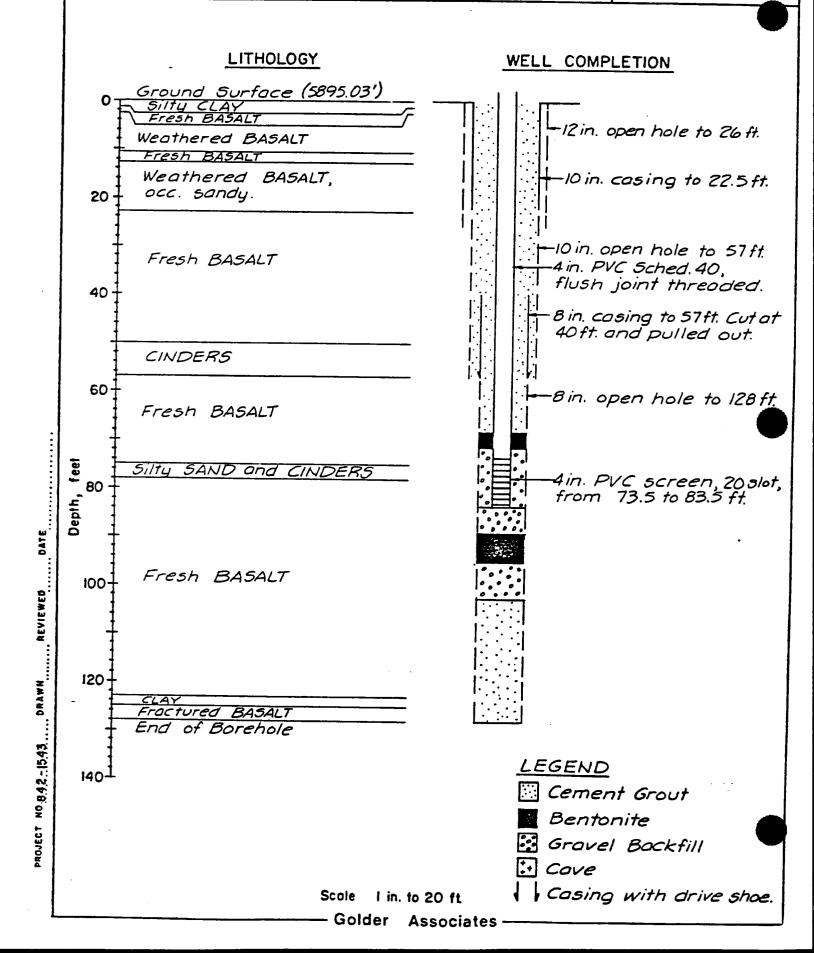
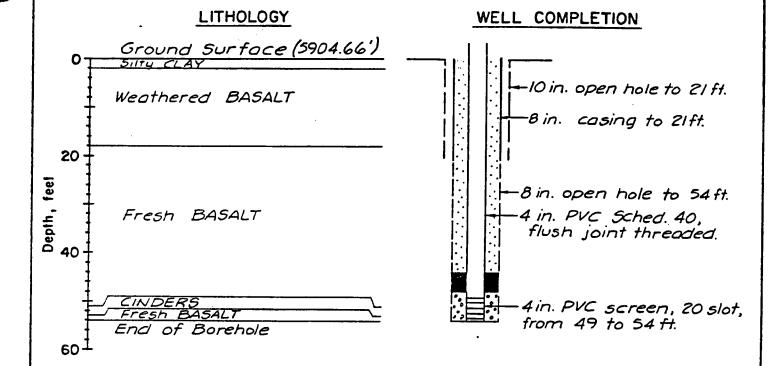


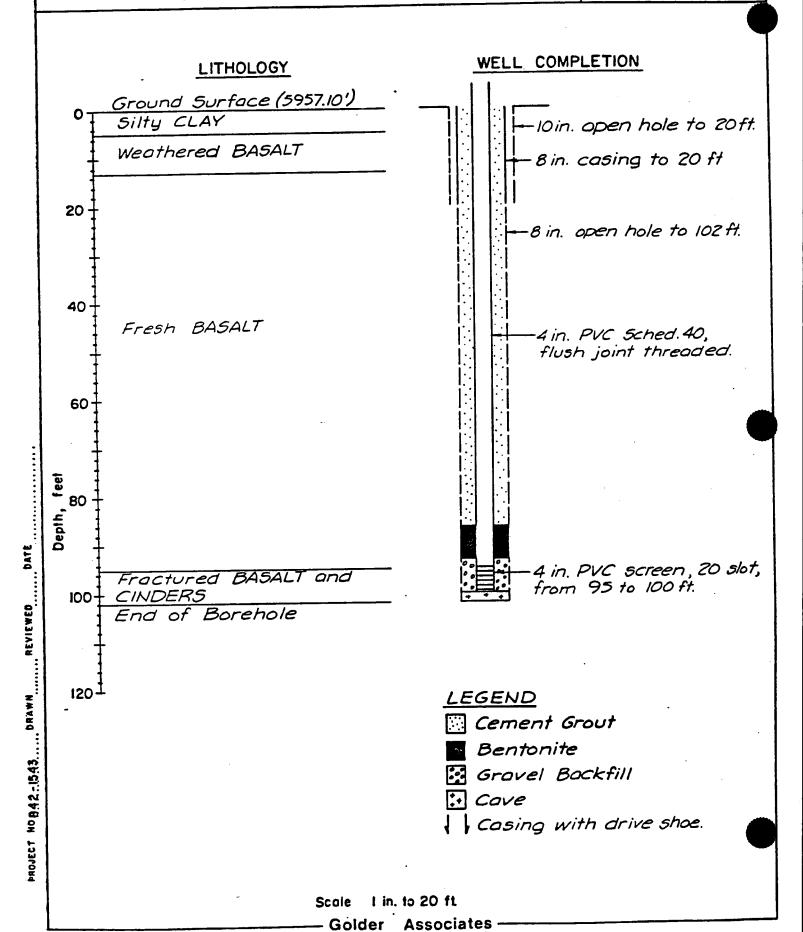
Figure H-36



#### LEGEND

- Cement Grout
- Bentonite
- Gravel Backfill
- : Cove
  - Casing with drive shoe.

NO 842-1543... DRAWN....REVIEWED



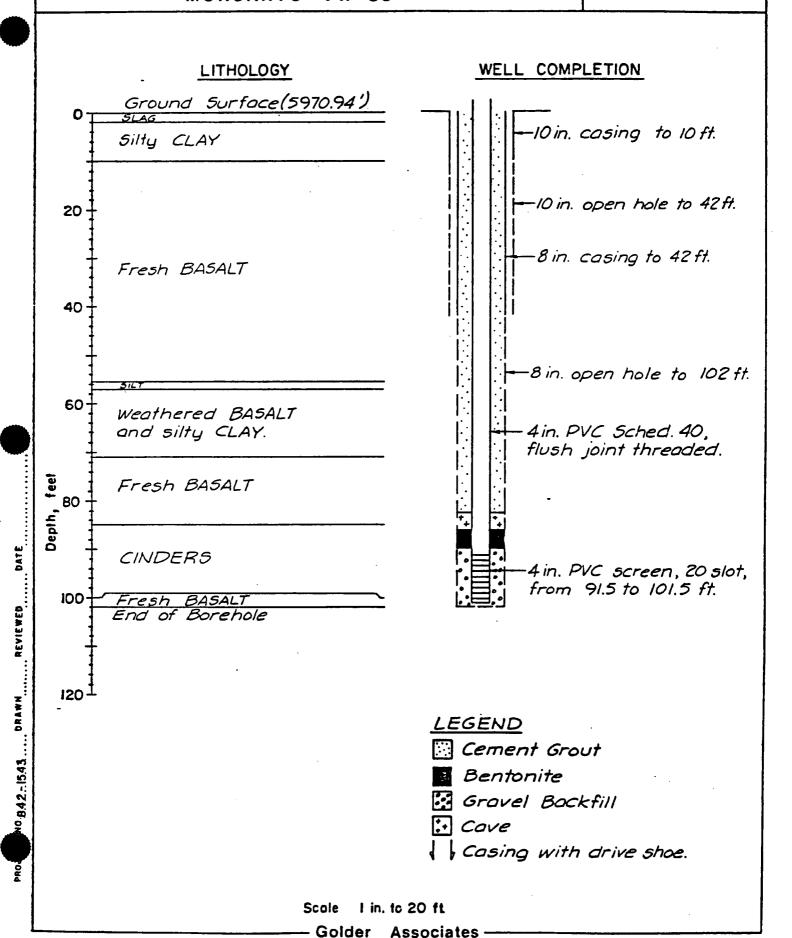
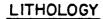
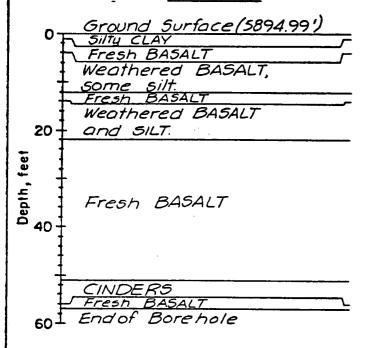
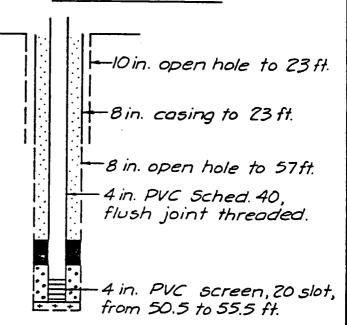


Figure H-39





#### WELL COMPLETION



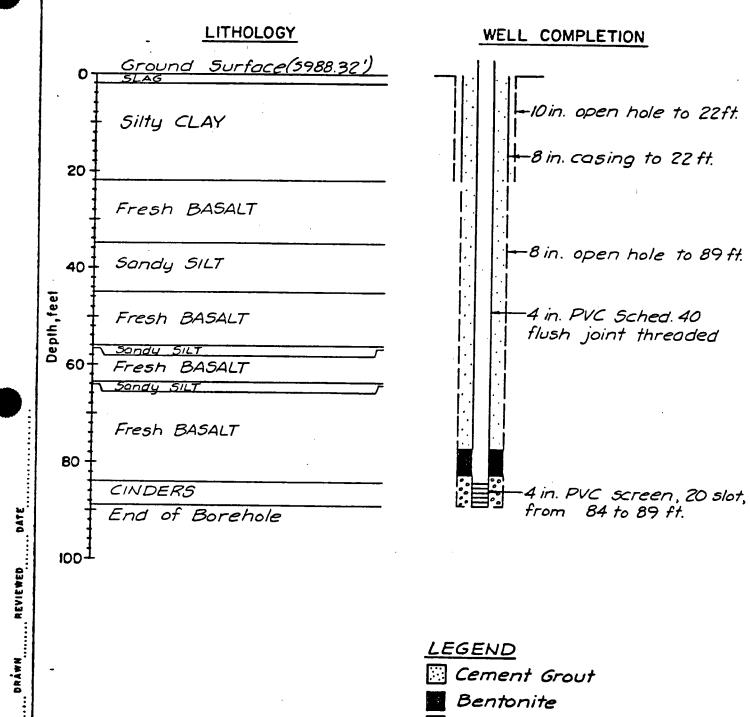
#### LEGEND

- Cement Grout
- Bentonite
- Gravel Backfill
- : Cove
  - Casing with drive shoe.

Scale 1 in. to 20 ft

- Golder Associates -

Figure H-40



#### LEGEND

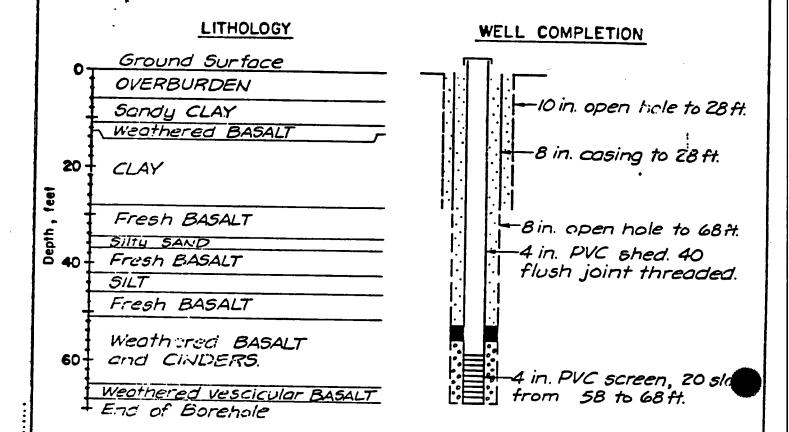
- Cement Grout
- Bentonite
- Grovel Bockfill
- : Cove
  - Casing with drive shoe.

Scale I in. to 20 ft

NO.842-1543

- Golder Associates -

Figure H-41



#### LEGEND

Cement Grout

**Bentonite** 

Grovel Bockfill

: Cave

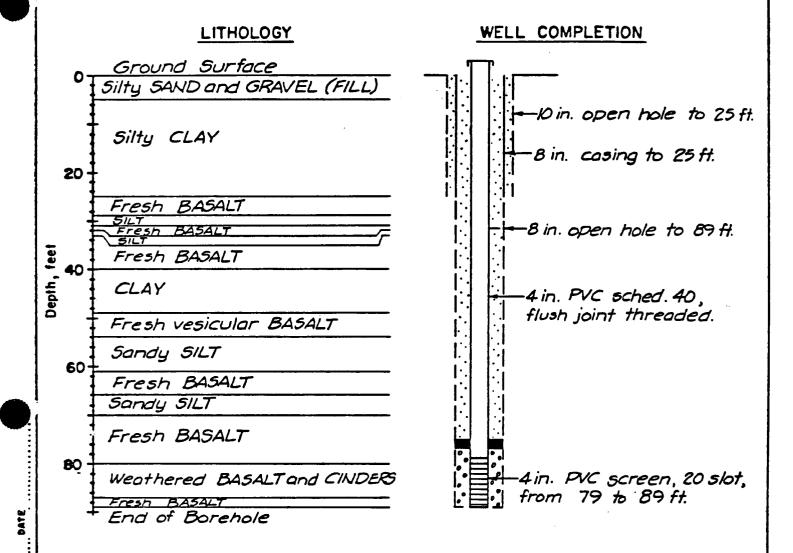
Casing with drive shee.

88.4

2

Ž

Figure H-42



#### LEGEND

Cement Grout

**Bentonite** 

Gravel Bockfill

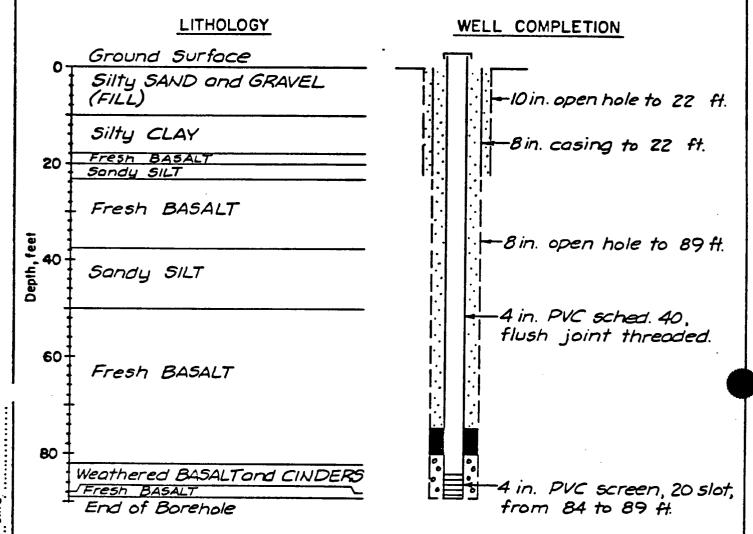
: Cave

Casing with drive shoe.

Scale 1 in. to 20 ft

- Golder Associates -

Figure H-43



#### LEGEND

- Cement Grout
- **Bentonite**
- Gravel Bockfill
- : Cave
  - Casing with drive shoe.

DRAWN REVIEWED

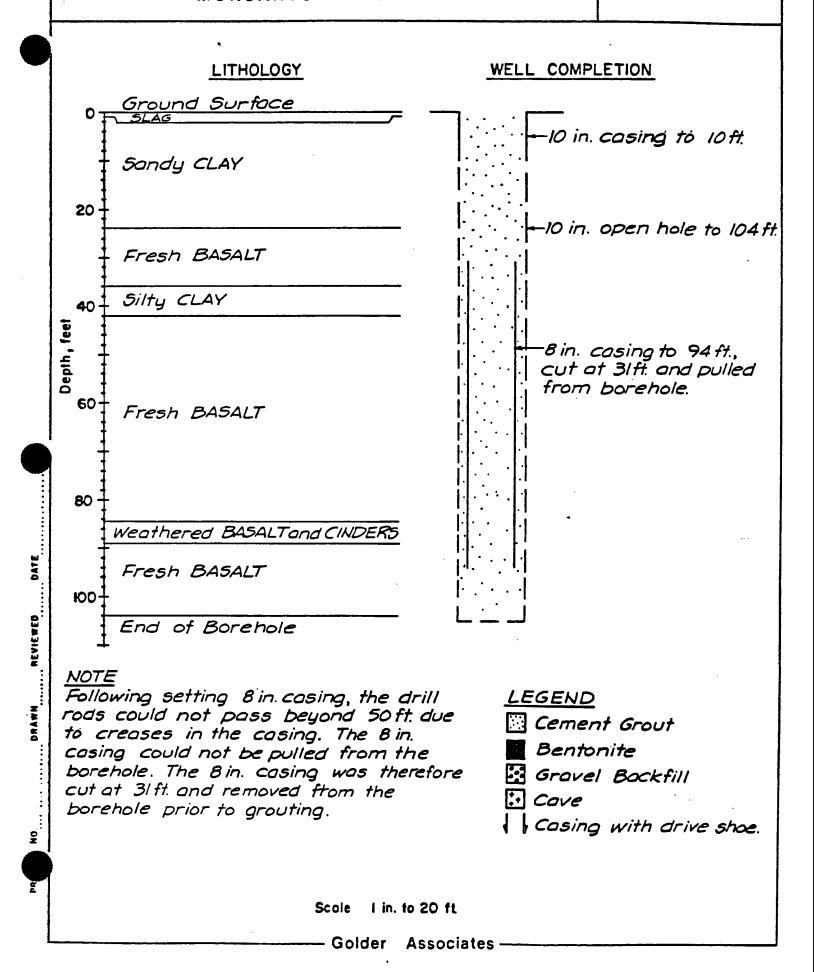
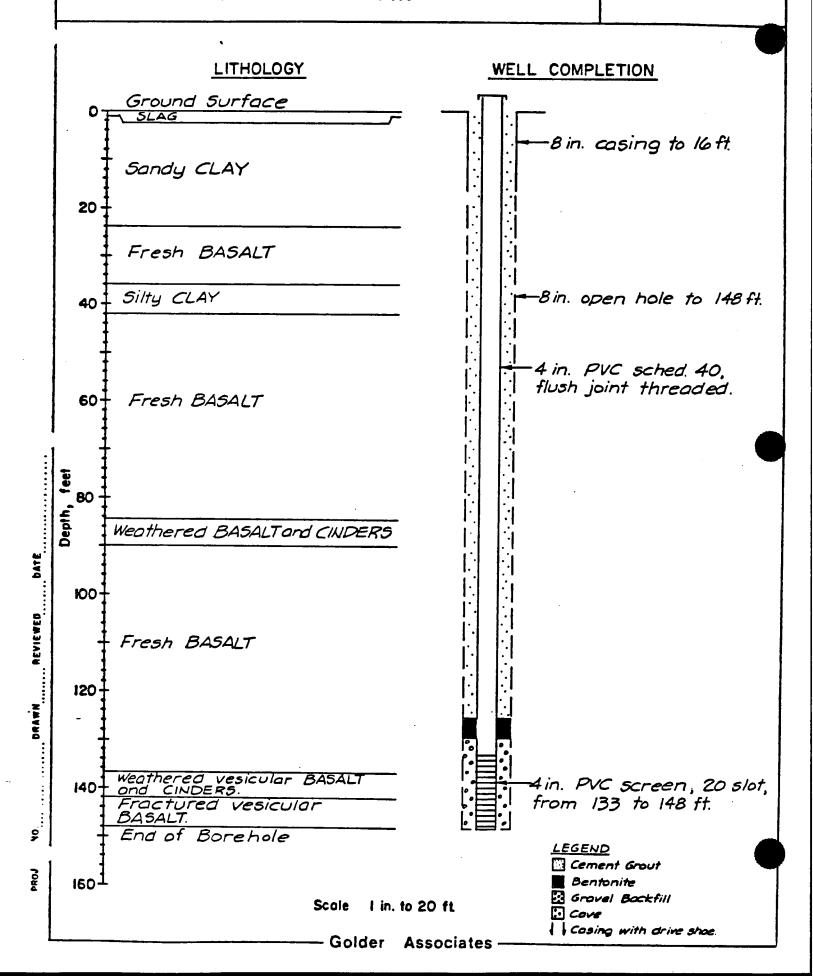
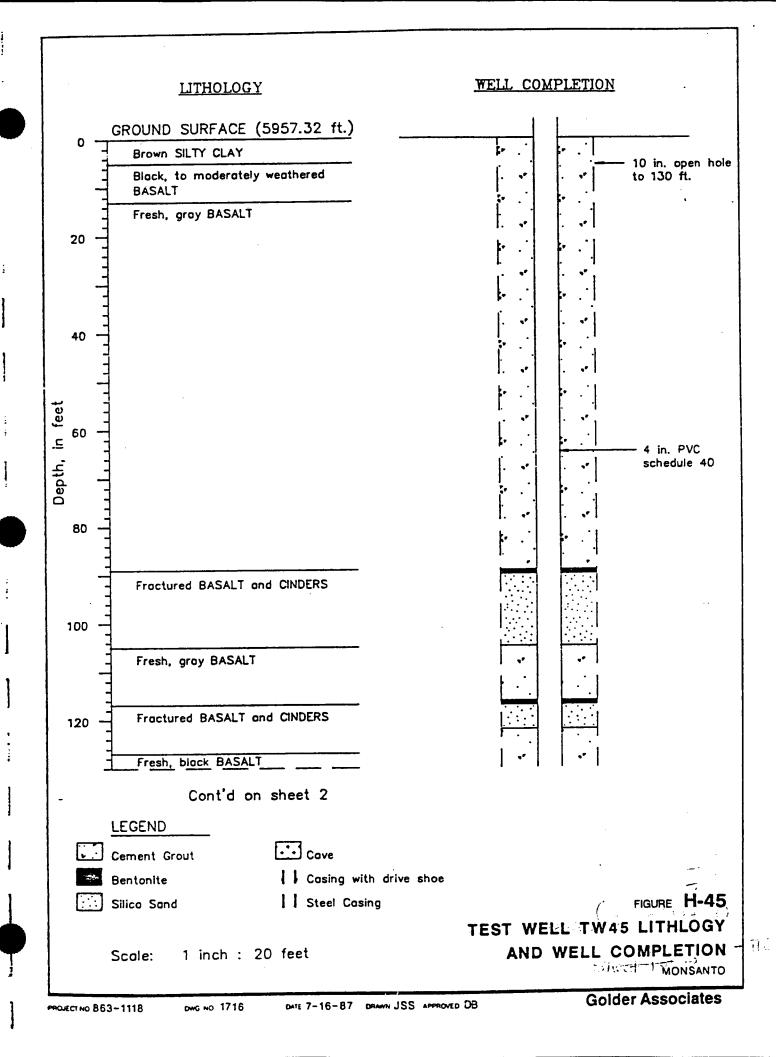
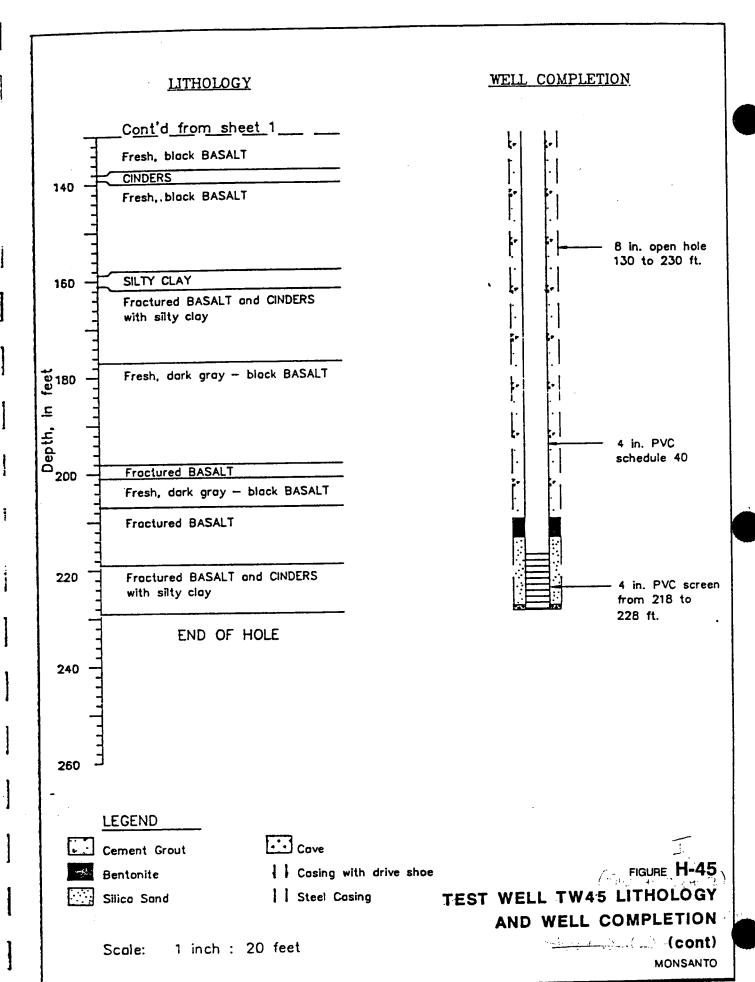


Figure H-44A







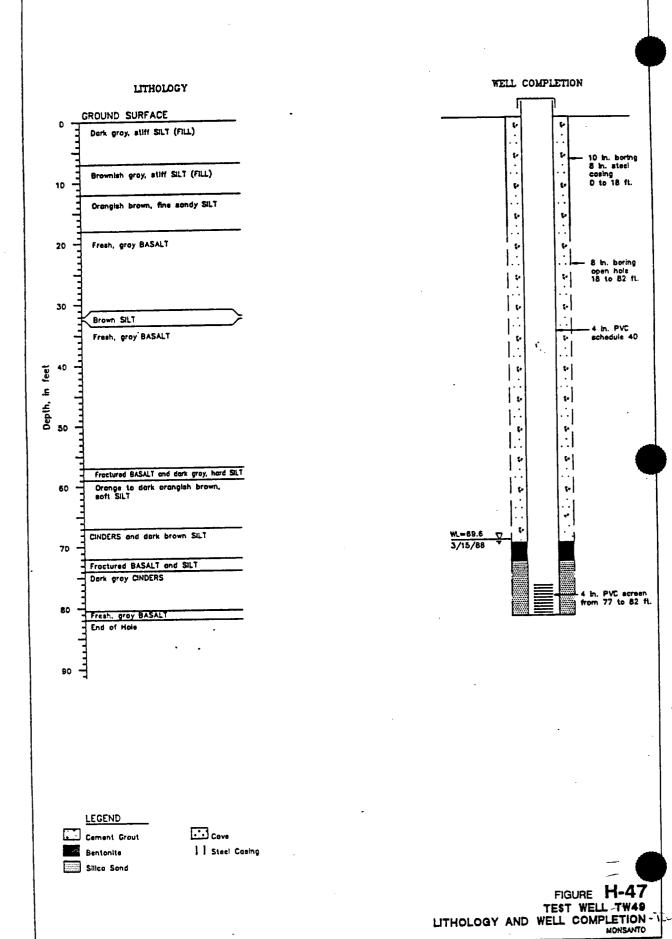
**Golder Associates** 

WELL COMPLETION LITHOLOGY GROUND SURFACE 5_AG (fil) **\$**-Brownish gray, fine sondy SILT ۲. S.LT end BASALT Orangish brown, stiff SILT 20 Fresh, gray BASALT Grangish, brown claye/ S:LT . 30 Fresh, grcy BASALT Orangish prown SIL? Fresh, gray BASALT CINDERS one SLT 4C feet Fresh, gray BASALT 2. Oepth. Gray fractured BASALT, some sit Orangish brown clayey SILT and CINDERS WL=57.6 3/15/88 60 Fresh, gray BASALT Froctured, groy BASALT End of Hole 90 LEGEND ∞۰۰ء 🔃 11 Stee! Cosing Bentonite

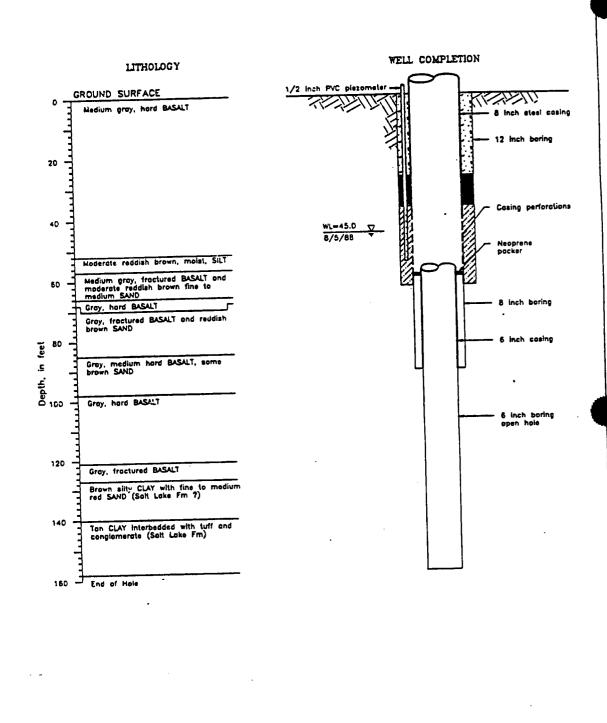
10 in. boring 8 in. stee! casing 0 to 7 ft. open hole 7 to 73 ft. 4 in. PVC schedule 40 1. ١٠. 4 in. PVC screen from 66 to 71 ft.

FIGURE H-46 TEST WELL TW48 LITHOLOGY AND WELL COMPLETION

76. 4



WELL COMPLETION LITHOLOGY GROUND SURFACE Ļ Dark brown, silty gravelly SAND 10 in. boring 8 in. steel cosing 0 to 11 ft. Orangish brown clayey SILT * 10 20 8 in. boring open hole 11 to 89 ft. Fresh, gray BASALT .. 30 CINDERS with orangish brown silty CLAY 4 In. PVC echedule 40 Fresh, gray BASALT * feet Brown, silty CLAY Fresh, gray BASALT ₽. . CINDERS and SILT Depth. i g Fresh, gray BASALT WL=57.0 ♥ | * 60 Fresh, gray BASALT 70 80 CINDERS in. PVC screen om 79 to 89 ft. Fresh, gray BASALT End of Hole LEGEND Cove Cement Grout | | Steel Cosing Silico Sand FIGURE H-48 LITHOLOGY AND WELL COMPLETION



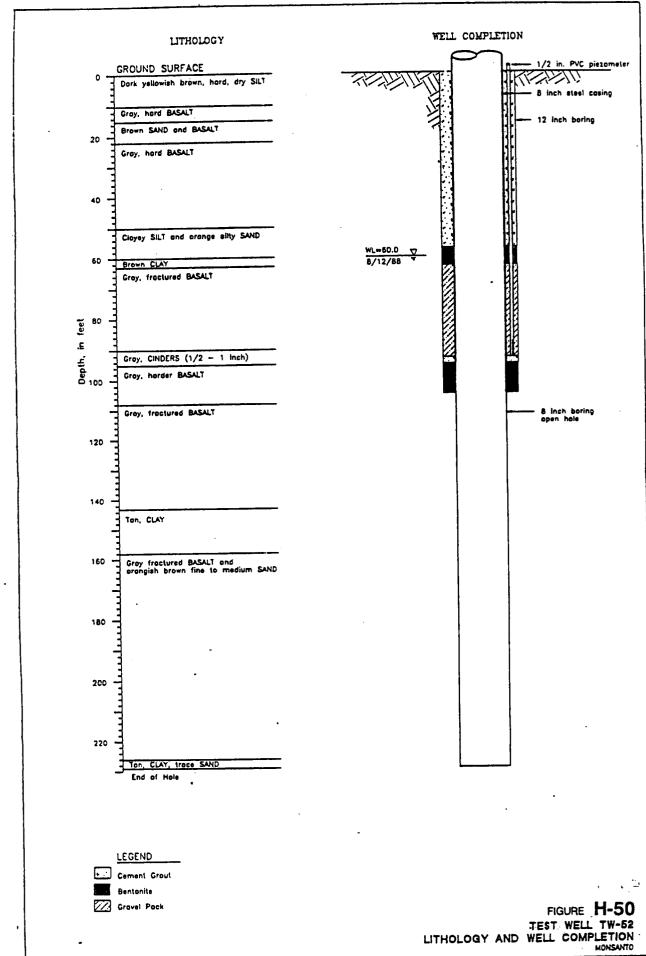
LEGEND

Cement Grout

Bentonite

Grovel Pock

FIGURE H-49
TEST WELL TW-51
LITHOLOGY AND WELL COMPLETION-



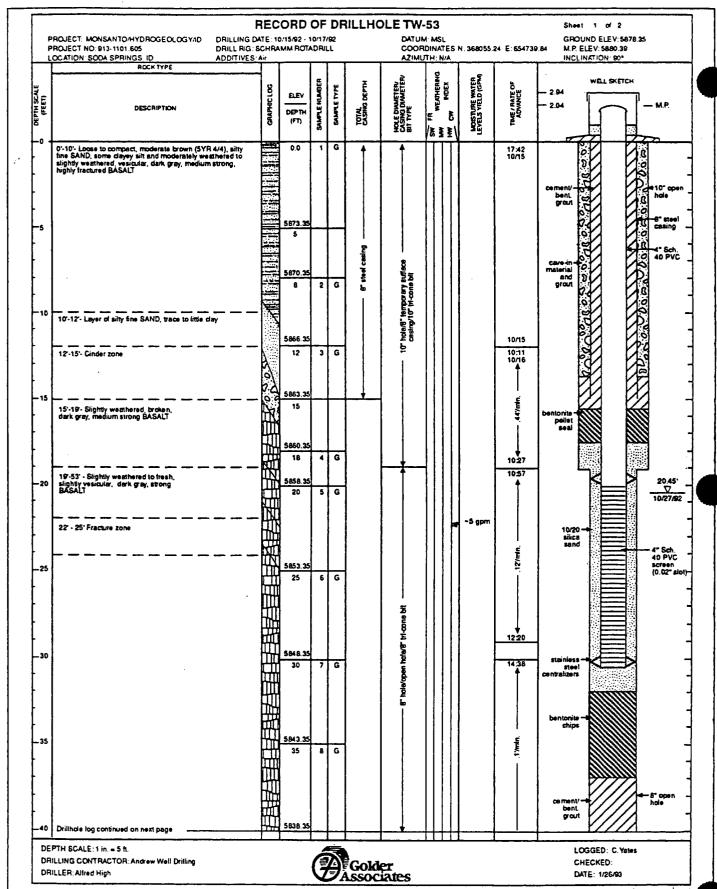


FIGURE A-1 (Sheet 1 of 2)

LITHOLOGY AND WELL COMPLETION - TW-53

MONSANTO/PHASE II RI REPORT/ID

P	ROJECT NO: 913-1101.605 DRILL RIG: 5	DRILL RIG: SCHRAMM ROTADRILL COORDINATES N: 368055							N:368055.2			
(FEET)	OCATION: SODA SPRINGS, ID ADDITIVES ROCK TYPE  DESCRIPTION	OBAPPHIC LOG	ELEV DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	TOTAL CASING DEPTH	LE DUMETER SING DIAMETER TYPE	SW FR WEATHERING H	MOISTURE WATER LEVELS VIELD (GPM)	TME / RATE OF ADVANCE	MELL SKETCH	
40- 45	19-53- Slightly weathered to fresh, dark gray, strong BASALT		5838.35 40 5833.35 45	10	G			76 3 2	1		cement/ - 8" apen hole	
50	53'-55'- Cinder zone		5828.35 50	11	G		8° hale/open hale/8" th-cone bit		-2 gpm	10/16 17:52 7:49 10/17		
55	55'-61.75'- Moderately weathered to slightly weathered, fractured and broken, dark grey, medium strong BASALT		5823.35 55 5818.35 60	12	G					. 24/min.		
65	BOH = 61.75' below ground surface		5816.60 61.75						C=670 µS/cm	10/17 8:43	61.75	
70												
75												
	PTH SCALE: 1 in. = 5 ft. IILLING CONTRACTOR: Andrew Well Drilling					<u> </u>	ler viates		]		LOGGED: C. Yetes CHECKED:	

FIGURE A-1 (Sheet 2 of 2)
LITHOLOGY AND WELL COMPLETION - TW-53
MONSANTO/PHASE II RI REPORT/ID

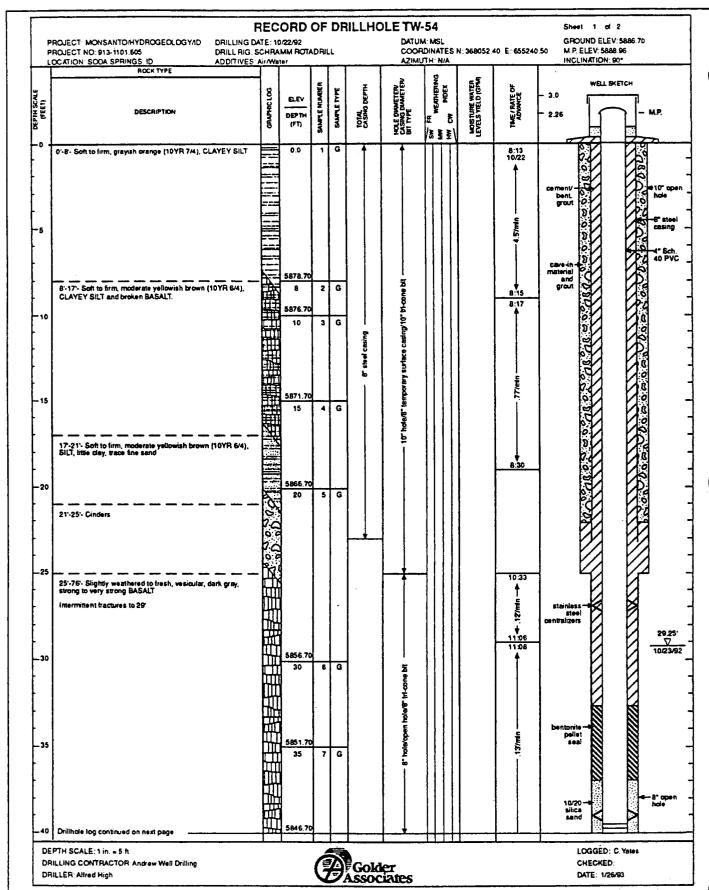


FIGURE A-2 (Sheet 1 of 2)
LITHOLOGY AND WELL COMPLETION - TW-54
MONSANTO/PHASE II RI REPORT/ID

V .

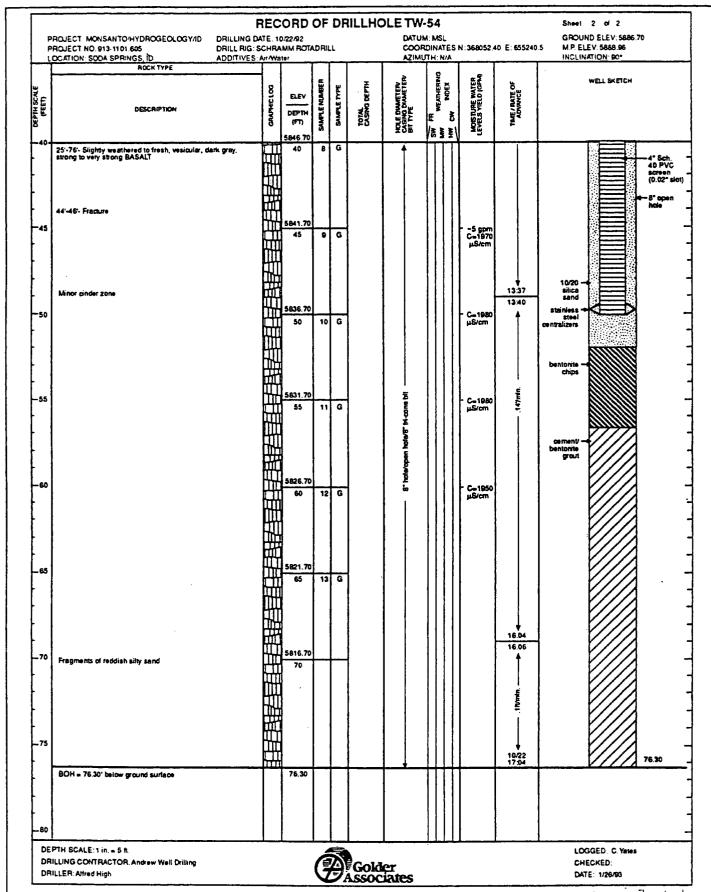


FIGURE A-2 (Sheet 2 of 2)

LITHOLOGY AND WELL COMPLETION - TW-54

MONSANTO/PHASE II RI REPORT/ID

1215

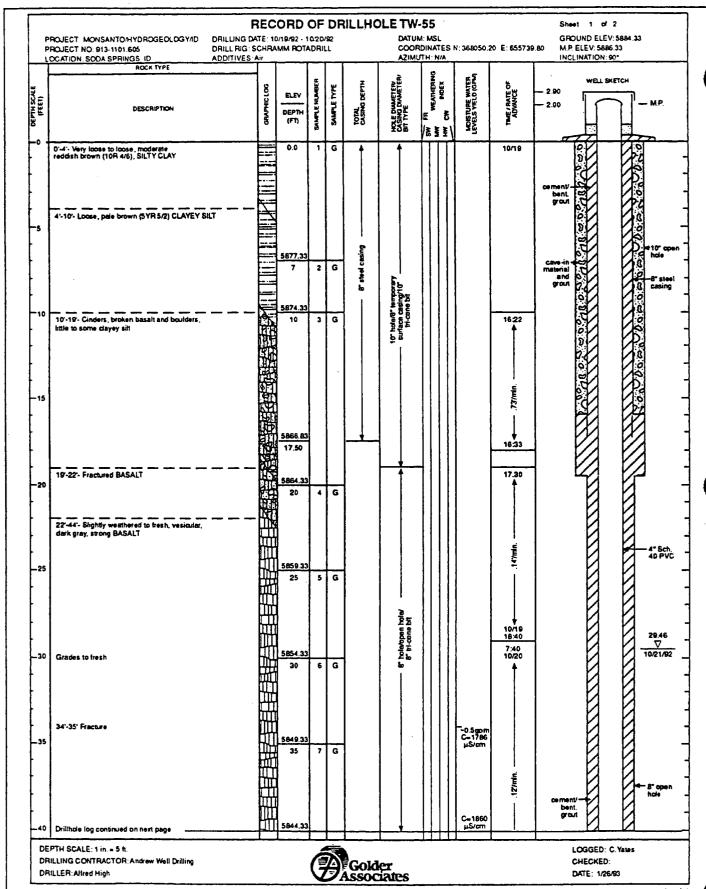


FIGURE A-3 (Sheet 1 of 2)
LITHOLOGY AND WELL COMPLETION - TW-55
MONSANTO/PHASE II RI REPORT/ID

114.0

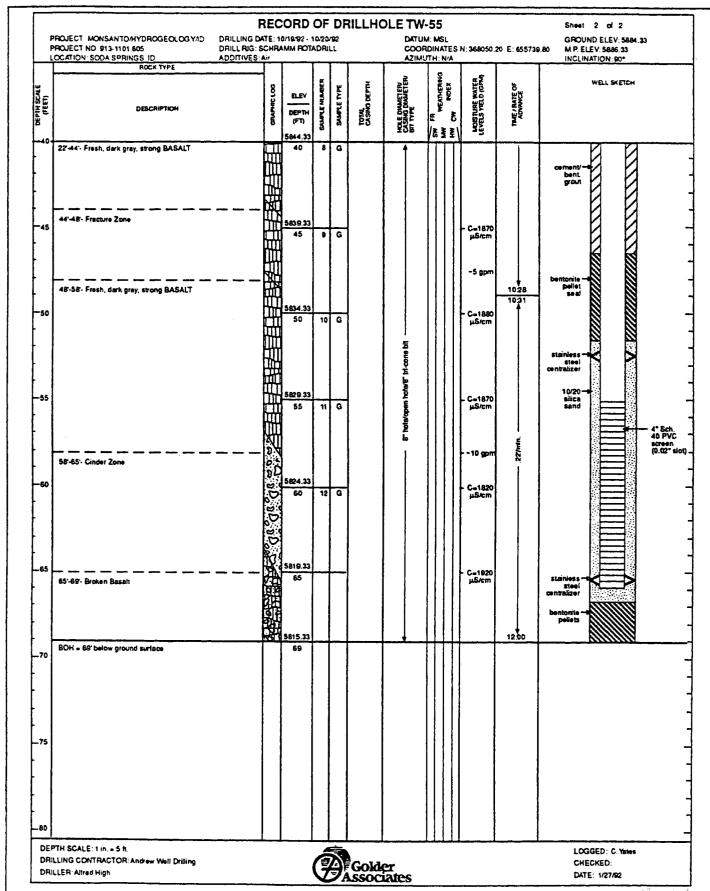


FIGURE A-3 (Sheet 2 of 2)

LITHOLOGY AND WELL COMPLETION - TW-55

MONSANTO/PHASE II RI REPORT/ID

17.

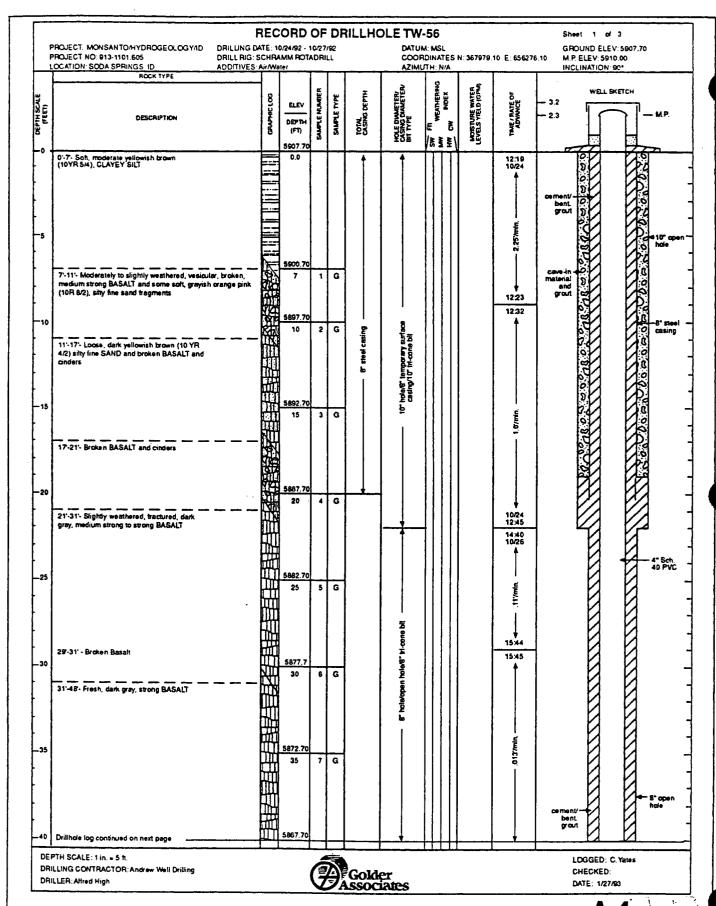


FIGURE A-4 (Sheet 1 of 3)

LITHOLOGY AND WELL COMPLETION - TW-56

MONSANTO/PHASE II RI REPORT/ID

 $M_{ij} : M$ 

P	ROJECT MONSANTO/HYDROGEOLOGY/ID DRILLING D	ATE:1	0/24/92 - 1	0.27	/92	ILLHO		M: MSL			Sheet 2 of 3 GROUND ELEV: 5907.70	
	ROJECT NO. 913-1101.605 DRILL RIG:: OCATION SODA SPRINGS ID ADDITIVES:		ADRI	LL			RDINATES I	N: 367979.	9.10 E: 656276 10 M.P. ELEV: 5910.00 INCLINATION: 90*			
DEPTH SCALE (FEET)	ROCK TYPE  DESCRIPTION	GRAPHIC LOG	ELEV DEPTH (FT)	SAMPLE MIMBER	SAMPLE TYPE	TOTAL CASING DEPTH	HOLE DWAETER CASING DAMETER BIT TYPE	SW FR WEATHERNO HW CW NDEX	MOISTURE WATER LEVELS VIELO (GPM)	TIME / RATE OF ADVANCE	WELL SKETCH	
	31'-48'- Fresh, dark gray, strong BASALT	Ш	40				1					
45 	grades to strong to very strong		5862.70 45	8	G					10/26 17/42 7:42 10/27	comenty—bent grout grout stainless steel contralizar	
- 50	45'-57'- Broken BASALT, little cinders, little soft to \$rm, moderate brown (SYR 3/4) sift		5857.70 50	9	G					7:54 7:56		
.			Ĩ	9	3		hole/open hole/6" trl-cone bit					
\$5			5852.70 55	10	G		ofe/apen hole					
-	57-78'- Moderately weathered to fresh, broken, dark gray, strong BASALT, little sitry fine sand		5847.70				1.6		-		4° 8ch 40 PVC 59.9 ∇	
-60	62'-65'- Menor cinders		60	11	G						10/27/92	
65 65			5842.70 65	12	G						steinless	
		目相								8:25		
70 -			5837.70 70	13	G					8:29	Bropen -	
_75 -		相用目	5832.70 75	14	G							
	78-83'- Broken BASALT, cinders, and little silt		5827.70									
_B0		1821	Vue7.70	느						<u> </u>		
DR	PTH SCALE: 1 in. = 5 ft ILLING CONTRACTOR: Andrew Well Drilling ILLER: Alfred High			É	園	Gold LSSOC	er				LOGGED: C. Yates CHECKED: DATE: 1/27/93	

FIGURE A-4 (Sheet 2 of 3)
LITHOLOGY AND WELL COMPLETION - TW-56
MONSANTO/PHASE II RI REPORT/ID

ilica

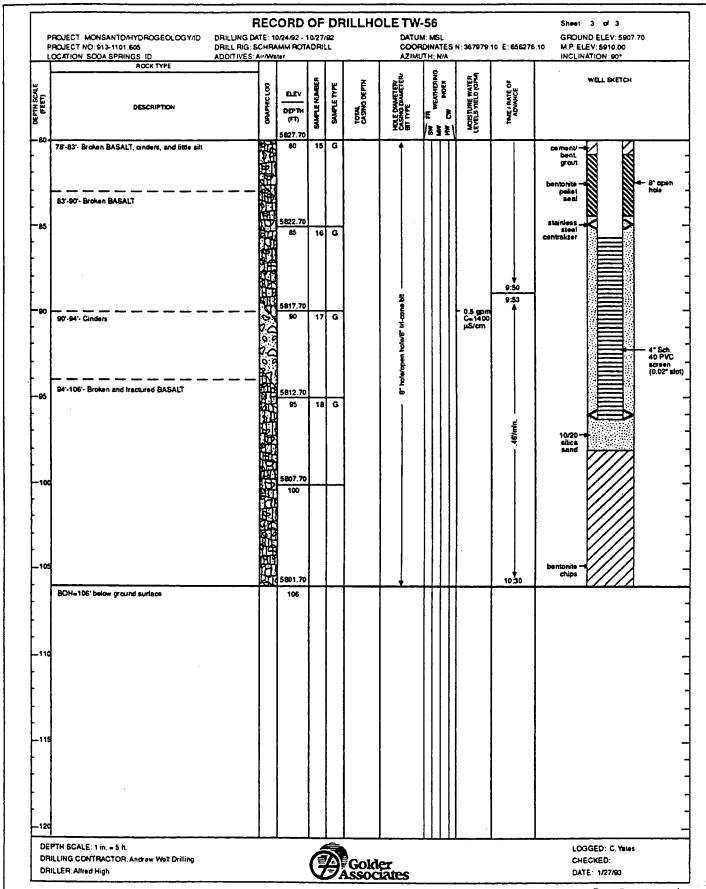
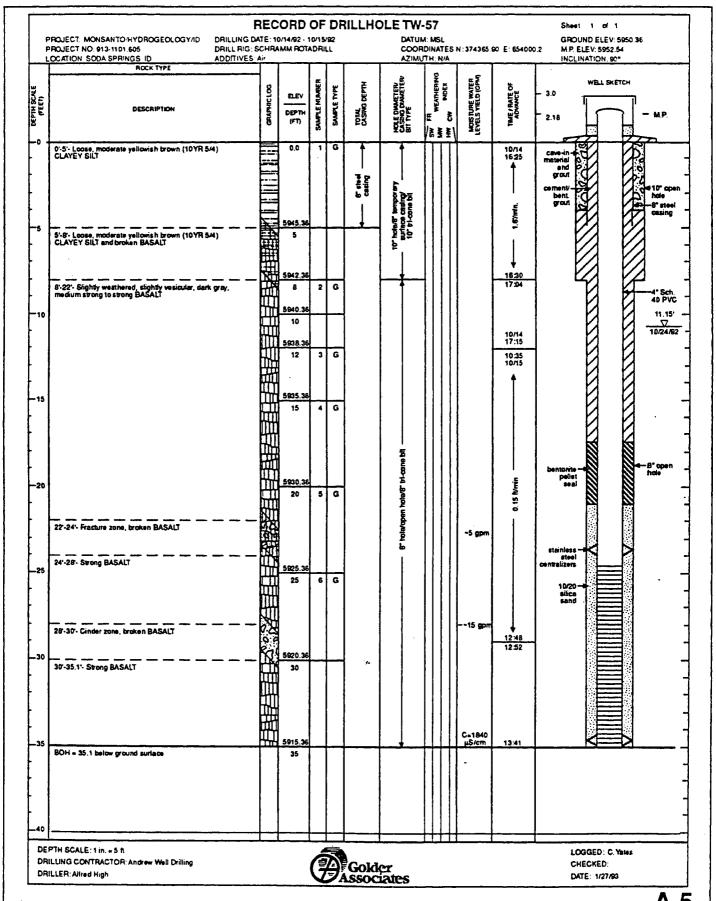


FIGURE A-4(Sheet 3 of 3)

LITHOLOGY AND WELL COMPLETION - TW-56

MONSANTO/PHASE II RI REPORT/ID

Also to



LITHOLOGY AND WELL COMPLETION - TW-57
MONSANTO/PHASE II RI REPORT/ID

115

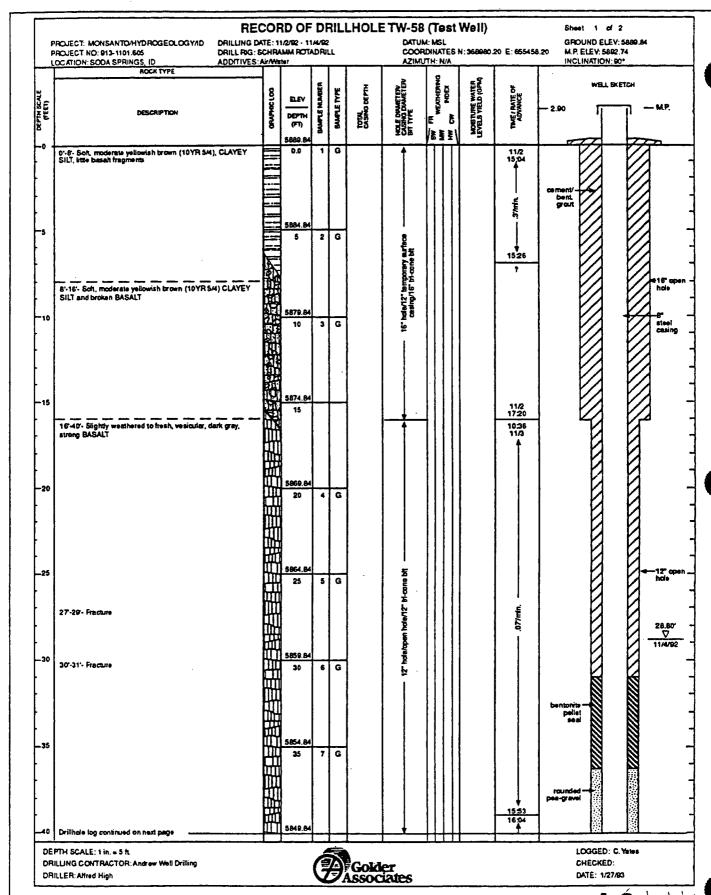


FIGURE A-6 (Sheet 1 of 2)

LITHOLOGY AND WELL COMPLETION - TW-58

MONSANTO/PHASE II RI REPORT/ID

PROJECT: MONSANTO/HYDROGEOLOGY/ID DRILLING DATE: 10/19/92 - 10/20/92 DATUM: MSL GROUND ELEV: 5889.84  PROJECT NO: 913-1101.565 DRILL RG: SCHRAMM ROTADRILL COORDINATES N: 368980.20 E: 655458.20 M.P. ELEV: 5892.74																
		DITIVES: A							TH: N/A	N: 368980.	- E: 605456	: 655458.20 M.P. ELEV: 5892.74 INCLINATION: 90"				
(FEET)	DESCRIPTION		GRAPHICLOG	BLEV DEPTH (FT) 5849.84	BAMPLE MUNBER	BANETE TYPE	HIA30 DM8A3	HOLE DAMETEN CASINO DAMETEN BIT TYPE	DW FR WEATHERING HW CW NOEX	MOBIUME WATER	TME / RATE OF ADVANCE	WELL SKETCH				
40	40'-42'- Broken BASALT 42'-47'- Cinders		5000 m	40 5845.84 44	8	O				~5 gpm - C=1460 µS/sm	.137min.	Tounded—  pee-gravel  (0.1" slot)				
45	47-55'- Broken BASALT		111110000	5839.84				12" hde/apen hde/ 12" ti-cone blis		- ~100 gpm C=1710 µS/cm	11/2 17/20					
-50				50	•	G				- C=2070 µS/cm C=2010 µS/cm	7:50 11/4	8' steel				
55	BCH-S5' below ground surface (hole caved in to 51.7' below ground surface after dril was completed)		1205	55			:	<b>-</b> _		ДОСП	<b>9</b> .19	1				
60																
65																
_																
70																
75																
80																
DRI	PTH SCALE: 1 in. = 5 ft. ILLING CONTRACTOR: Andrew Well Drilling ILLER: Altred High			*9			Gold	er iates				LOGGED: C.Yates CHECKED: DATE: 1/27/82				

FIGURE A-6 (Sheet 2 of 2)

LITHOLOGY AND WELL COMPLETION - TW-58

MONSANTO/PHASE II RI REPORT/ID

マックス: ひらじん

# ANDREW WELL DAILLING

Contractors Flicho 532-2794

Pump and Well Drilling Equipment Installed 1263 E. 17th St., letho falls, letho

NURS DEMINISTED VANIER IS THE ESCRICE OF URS. LET US COME TOUS VALL, AND YOU WHILE IT SATISFIED.

Et: Proposito Christant Con	DATILIER: Words Harbat
es: Sodo Spidago, Idaho	mc no: 361-6
SS:	Demostic Industrial Municipal
Dillows	Irrigation Tost Woll Othor
DISCRIPTION:	
H TO WATER: D.C5V  RIC TIME: REMARKS:	FOOTAGE: FORMATICH:
. R. 3945	0-5 Way
Pack Milling & rhomang ethnicitining boloCot 12 to 15-16	25-30 Alogi moli
	35-10 Fim black molt  10 35-10 Fim black molt  10 10-15 Fim black m
	50-55 Firm block r

97309 DigILLER:_ ' Honsento Chemical Company FORMATION FOOTAGE: ER ARKS: BIG NO: Broken rock & cinican - "" 58-60 Broken rock & cincett - sed 60.65 Brokon black lava rock 65-70 Process black lava rock 70-75 Caving 75-80 Seving 80-35 Hot formation 9215" pf 20" pipe 96. Caving 85-90 Firm black lava rock 90-95 Total Langth of 20' pips 101:50 95-100 100-105 17tsa 105-110 110-115 20.00 Z CO 200 200 172-150 **(1** 120-125 125-130 Firm black lave rock 130-135 Cindors - water 135-140 140-145 77 145-150 150-152 Firm black lava rock 152-158 Broken - water 158-160 Pim 160-155 1:5-170 170-175

range

# #3 deep Well

Markanto Digital Compage

. *5.* •.

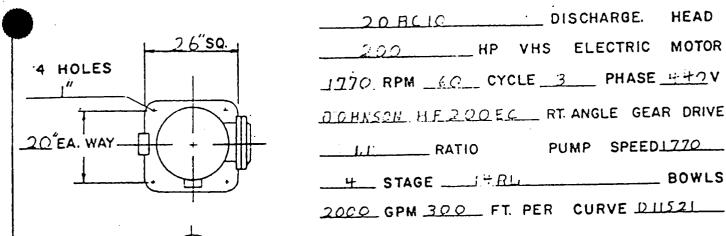
FOOTAGE: FORMATION PTC NO: ED ARE: M 175-180 Firm black laga rock **٤**ږ 180-185 Chocking water tempture 185-190 Ofton. Temp. dropping slowly from 96° Broken - water 190-195 to 62° KF ERA FE 195-200 Minn. Pirm. 200-203 203-214 Cindors - water Firm rock - lava 214-220 776 220-225 225-230 Cindoro - naior Firm have rock 236-235 235-240 240-245 245-250 250-255 Installed five joints of 16" perforated pipo & three joints of plain pipo. One 16" drive shop on better of pipo. First joint to plain pips 20%, next three joints is perferated. Lengths of cach 10 2013" - 2012" - 2012" One joint of plain pipe next 2013", then two joints of parforated - 2012" end 2011 last one -- joint of plain 20' overall menourement 161°5"

# Veri-Line DEEP WELL PUMP

Pampa

MPO 1 97309 =





2-3/4-DIA. SHAFT W/ 25.X.516K.W.

18

2001

206"714" 3 1/4"

24"

DISCHARGE FLANGE 10" - 150 118

10" PIPE COUPLING O.D. 113/4"

10" COLUMN PIPE IN 20" LGTHS.

3" ENCLOSING TUBE IN 5" LGTHS.

1 W/6" LINESHAFT IN 20" LGTHS.

TOTAL OVERALL COLUMN LGTH 200'

### LAYNE & BOWLER PUMP CO.

PROPOSAL FOR LIE - LICAN

11011 - HILLIO - LICAN

SPEC - ITI

CERTIFIED - LIE - L. B. B.

# USE TMPEWRITER OR

### State of Idaho Department of Reclamation

WELL DRILLER'S REPORT

State law requires that this report be filled with the State Reclamation Engineers as a second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second sec

within 30 days after complet	tion or	abando	nment	of the well.						
1. WELL OWNER  Name	1.33	4	LEVEL	15 - 7 feet below land surface						
Address SODA SPRINGS IPALIC		lowing	Y	es						
[-,-] . The second $[-,-]$ is $[-,-]$ . The $[-,-]$ is $[-,-]$ in $[-,-]$ .	1.A	rtesian	closed-i	n pressurep.s.i						
Owner's Permit No.	1.5		• • • • •	THE THE STATE OF THE STATE OF						
2. NATURE OF WORK			(e)	NTA A A A A A A A A A A A A A A A A A A						
New well ☐ Deepened ☐ Replacement	0		G.P.M.							
"D'Abandoned (describe method of abandoning)				106'						
	<del> </del>		-11.4							
3. PROPOSED USE	,	4 2								
☐ Domestic ☐ Irrigation ☐ Test	.9. I		OGIC L	Weter						
☐ Municipal ☐ Industrial ☐ Stock	Diam.	From	70	Material Yes No  LOOSE LAYA ROCK + COAL						
4. METHOD DRILLED		17	36	CREVICED LAYA						
')☑ Cable □ Rotory □ Dug □ Other		36	57	BROKEY LAYA" SOFT P						
5. WELL CONSTRUCTION		61	64	LAYA MED						
Diameter of hole inches Total depthfeet		1 PM		The state of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second						
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Diameter_ Slot size Set from feet to feet		<u> </u>								
Gravel packed? □ Yes □ No Size of gravel	1 \$2. ,	24.76		1, 5, 5, 5, 5, 5, 6, 7, 7, 8, 7, 8, 7, 8, 7, 8, 7, 8, 7, 8, 7, 8, 8, 7, 8, 8, 7, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8,						
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USE TYPEWRITER OR BALL POINT PEN

## Department of Water Administration

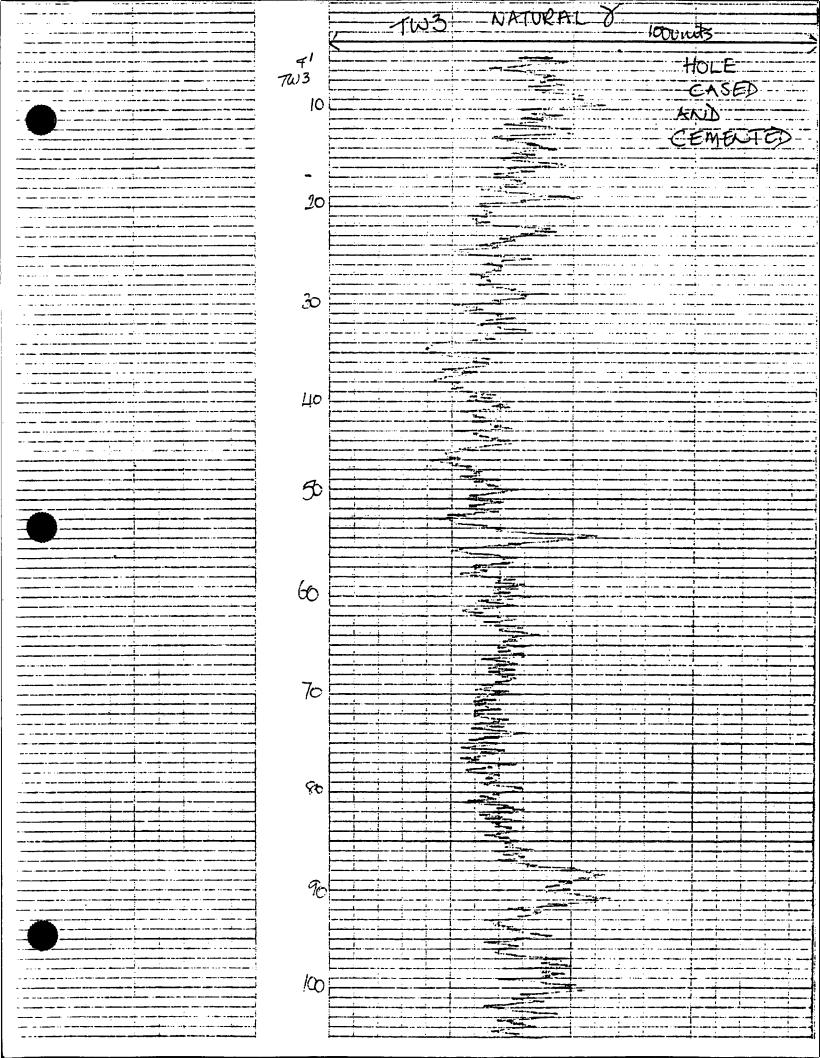
## WELL DRILLER'S REPORT

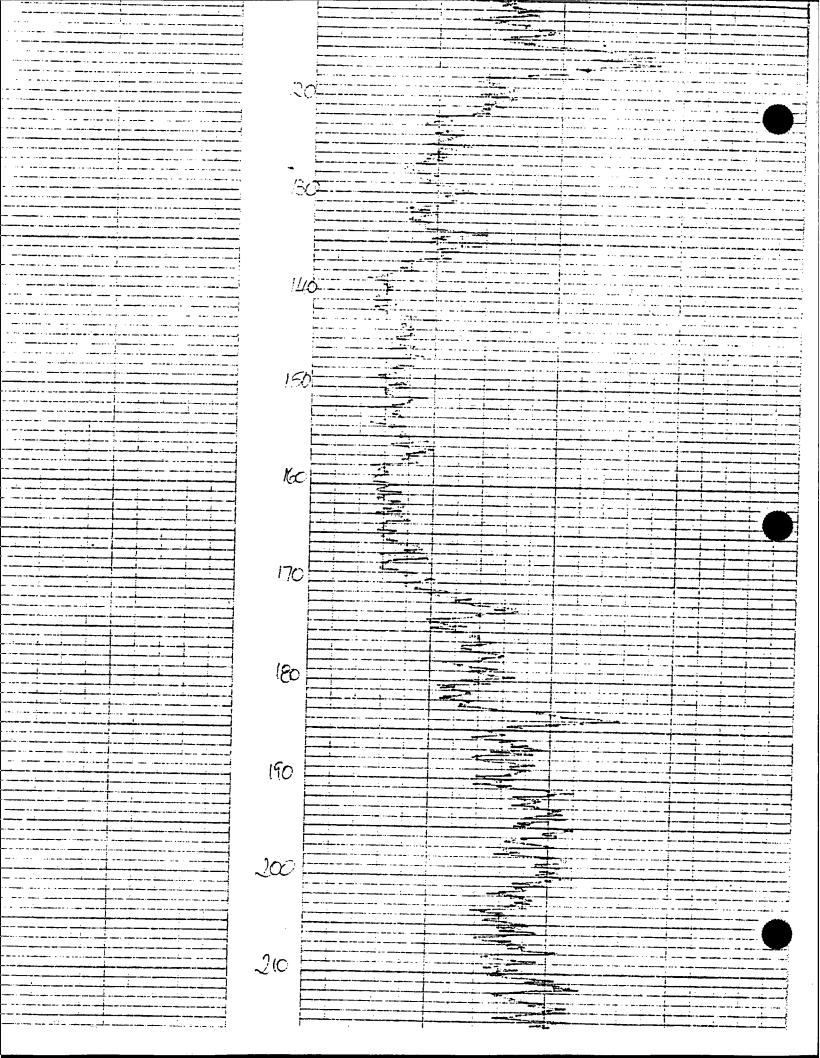
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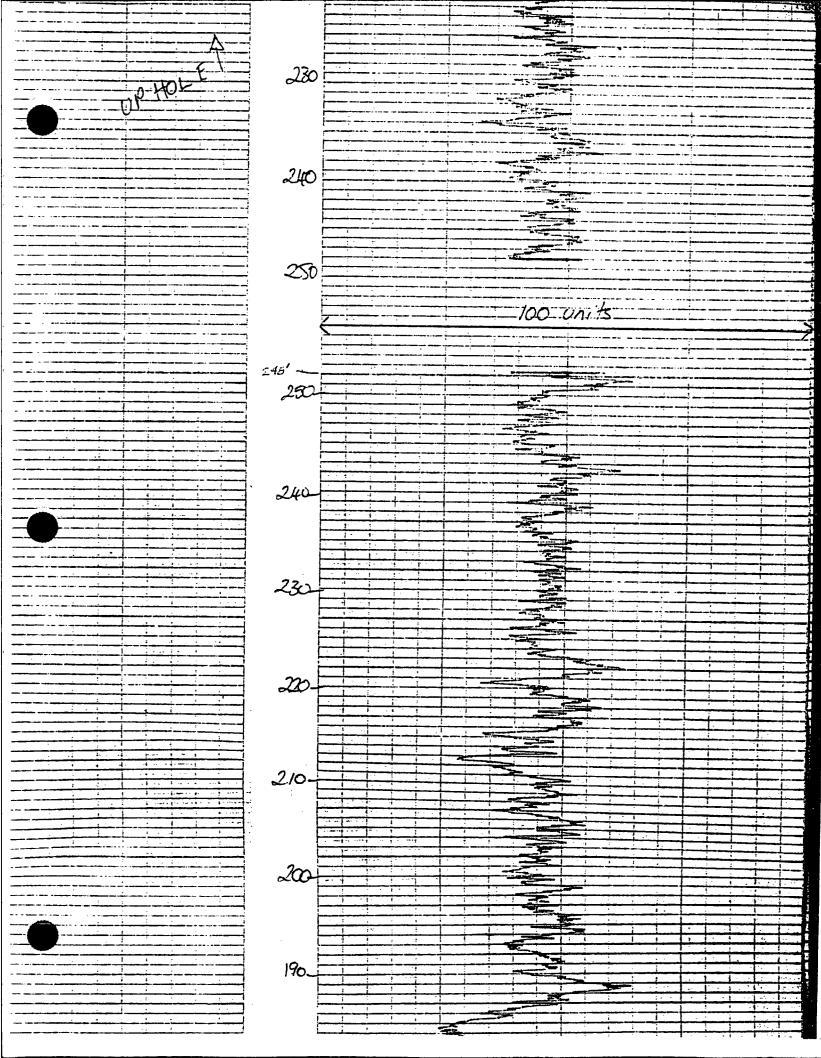
State law requires that this report be filed with the Director, Department of Water Administration with 1980 20 1974 days after the completion or abandonment of the well.

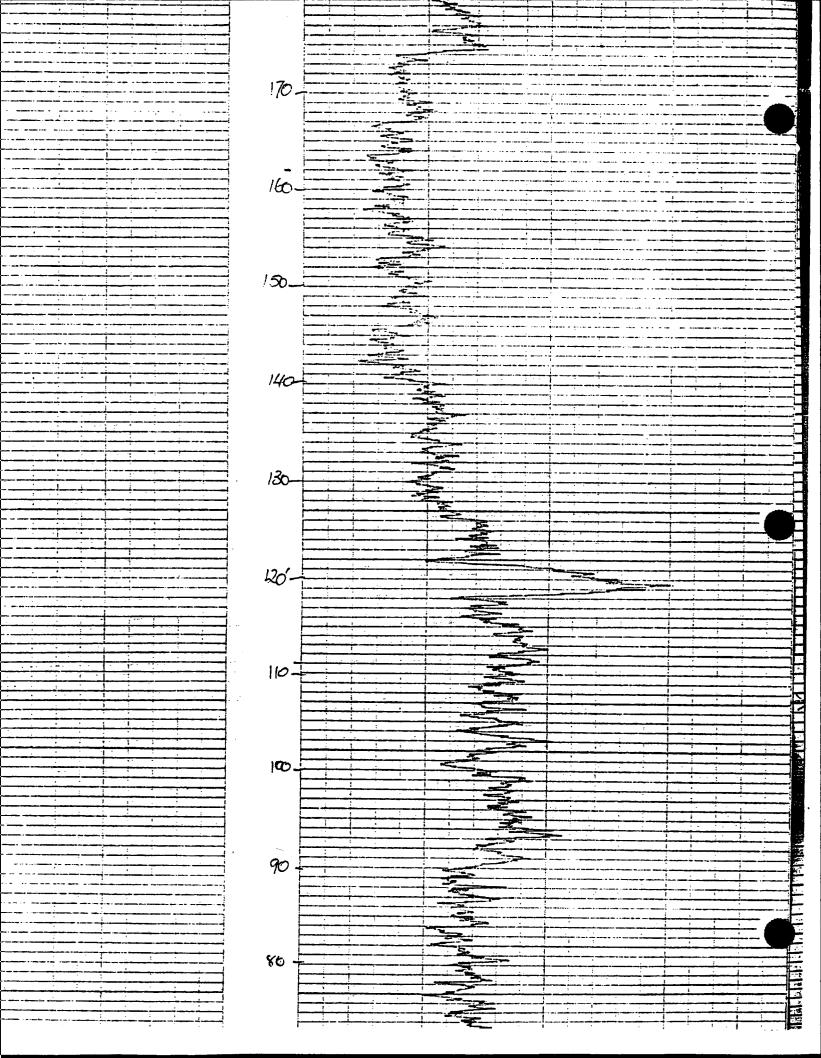
				Dan	A						
1. WELL OWNER		ATER			Castern I:	hater Research	es .	-			
Name LARRY Lewis	Static water level 27 feet below land surface										
Address Sodd Springs, Id. 83276	Flowing? [] Yes [J] No G.P.M. flow Temperature <u>44°</u> F. Quality <u>Good</u>										
	Artesian closed in pressurep.s.i. Controlled by   Valve   Cap   Plug										
Owner's Permit No.											
2. NATURE OF WORK	8. W	ELLITE	EST DAT	ГА							
UNew well □ Deepened □ Replacement		Pump			Other	Hours Pu					
☐ Abandoned (Jescribe method of abandoning)	<u>D</u>	ischarge ( ان حی	<u>_</u>	Draw Do	WN	1					
								=			
3. PROPOSED USE				•				-			
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☐ Municipal ☐ Industrial ☐ Stock ☐ Waste Disposal or Injection	Hole Diam.		To		laterial		Yes				
4. METHOD DRILLED	12.14	9	9	Kard Ma	<u> </u>	Lava		生			
r.	7 1/8	19	24	"	"	"	X	7			
¹[ ] Cable	<u>"</u>	34	35	Red CIN.		Lava		X			
5. WELL CONSTRUCTION	6 Y4	+	41	11	"	"		Z			
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Size of perforation inches by inches		1									
Number From To 240 perforations 85 feet 105 feet	F	ļ	ļ				┼	-			
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Well screen installed?	-	┼──	<del> </del>		<del></del>						
Manufacturer's name	·二		ļ								
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Diameter Slot size Set from feet to feet		1					1_	<u>_</u>			
Gravel packed? [] Yes [2] No Size of gravel		-	ļ	<del> </del>			-	<del> </del>			
Placed from feet to feet		-	<del> </del>								
Surface seal depth	$\Box$	ļ					┥	<del> </del>			
Puddling clay Well cuttings	,	┼	+	<del></del>							
☐ Puddling clay ☐ Well cuttings  Sealing procedure used ☐ Sharry pit ☑ Descripty surface cosing		1.					<u> </u>				
D Overbore to seel depth	۱۱										
6. LOCATION OF WELL	10.	Work st	arted	7-28.74	_finished	8-15-	7 Y				
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			(Op	erator)							
NE 1/2 S.F. 1/2 Sec. 6 T. 7 19/5, R. 42 E/16	4										

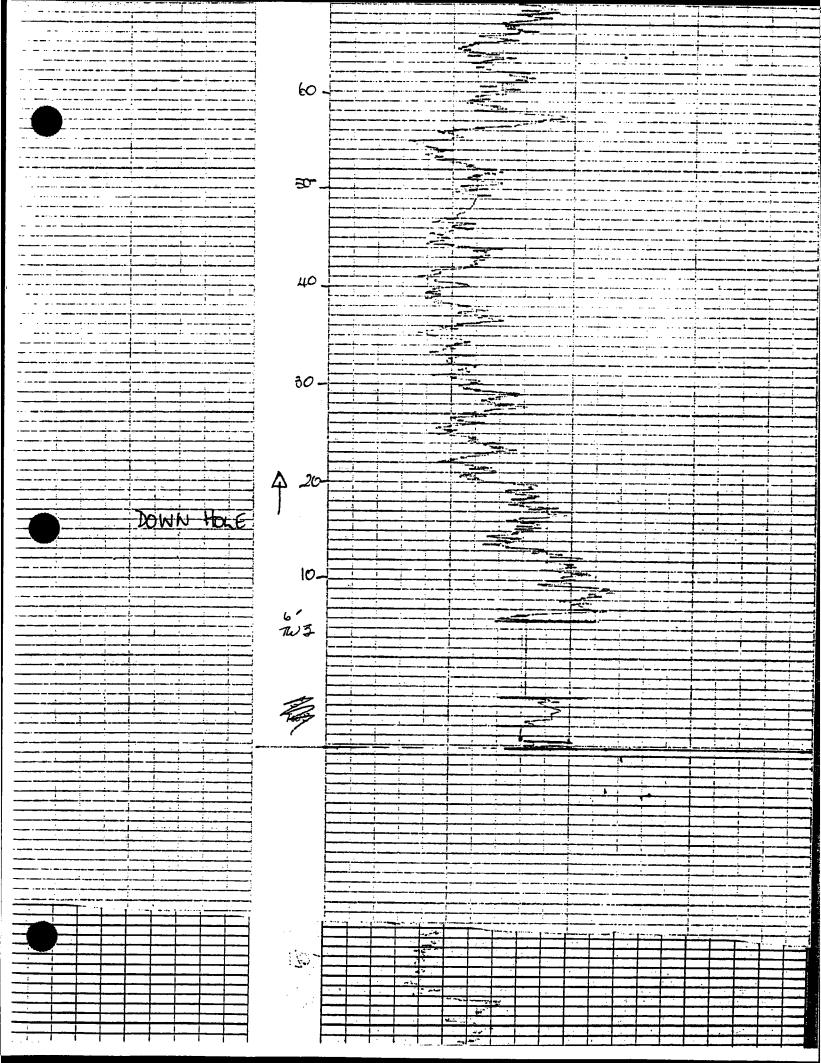
# APPENDIX H-2 GEOPHYSICAL BOREHOLE LOGS



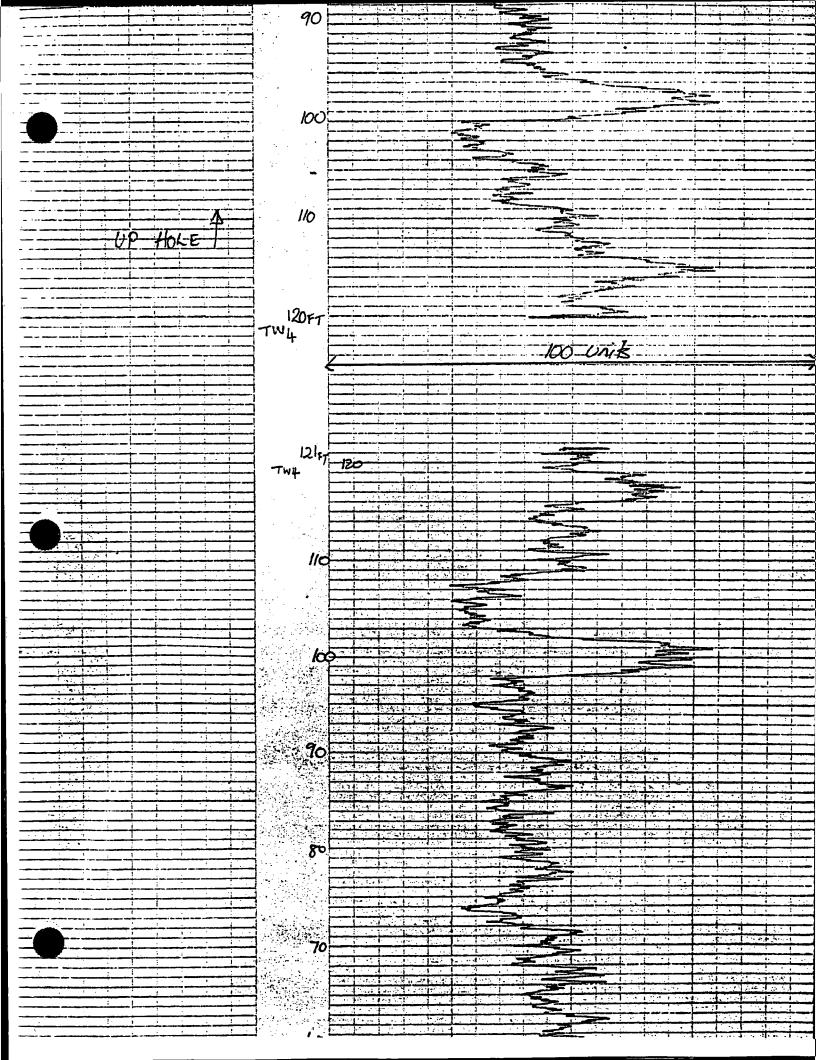


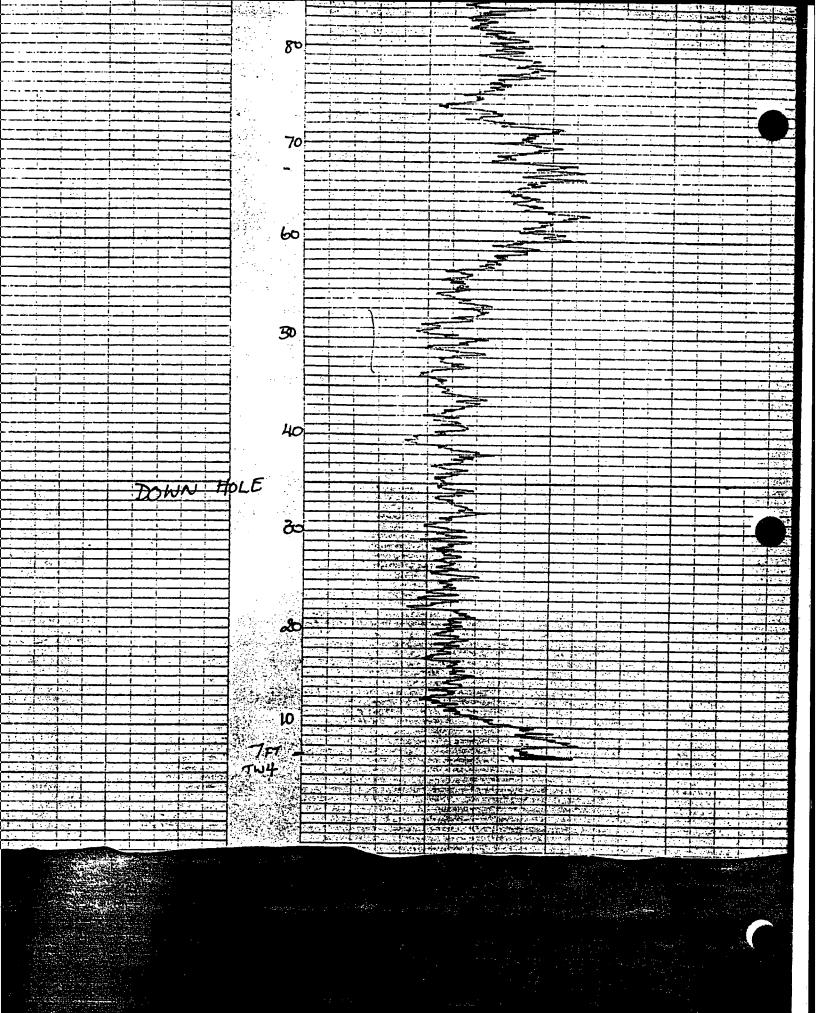


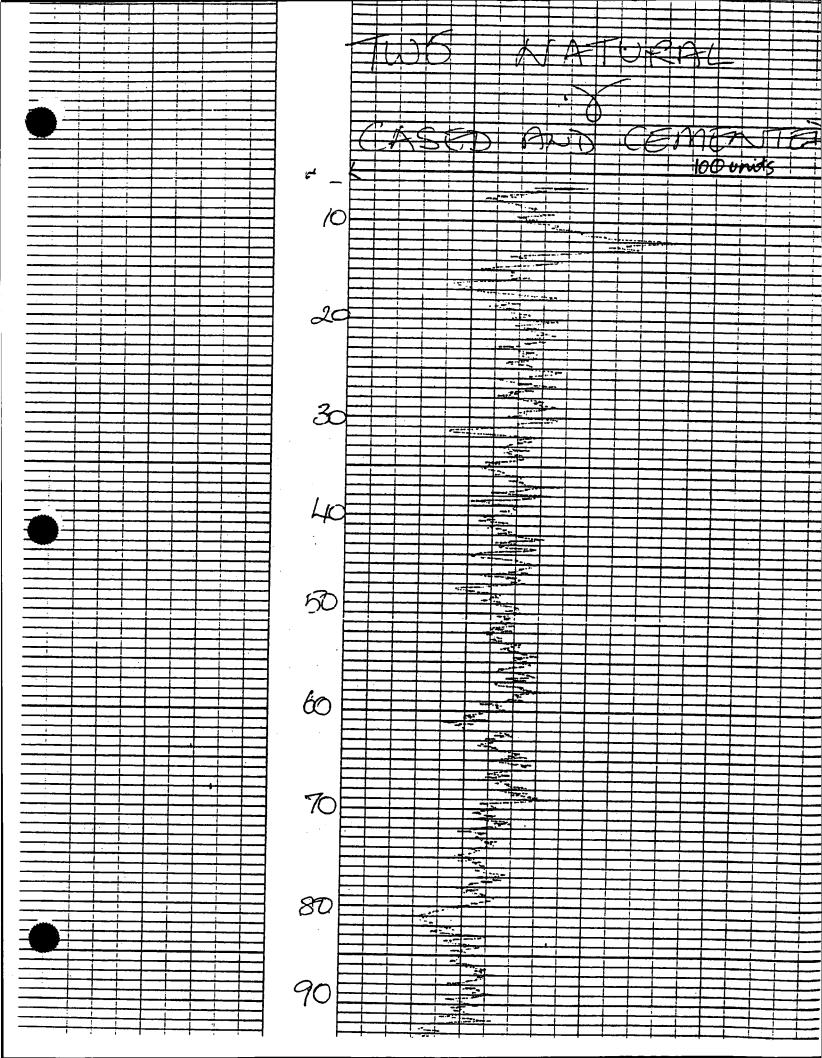


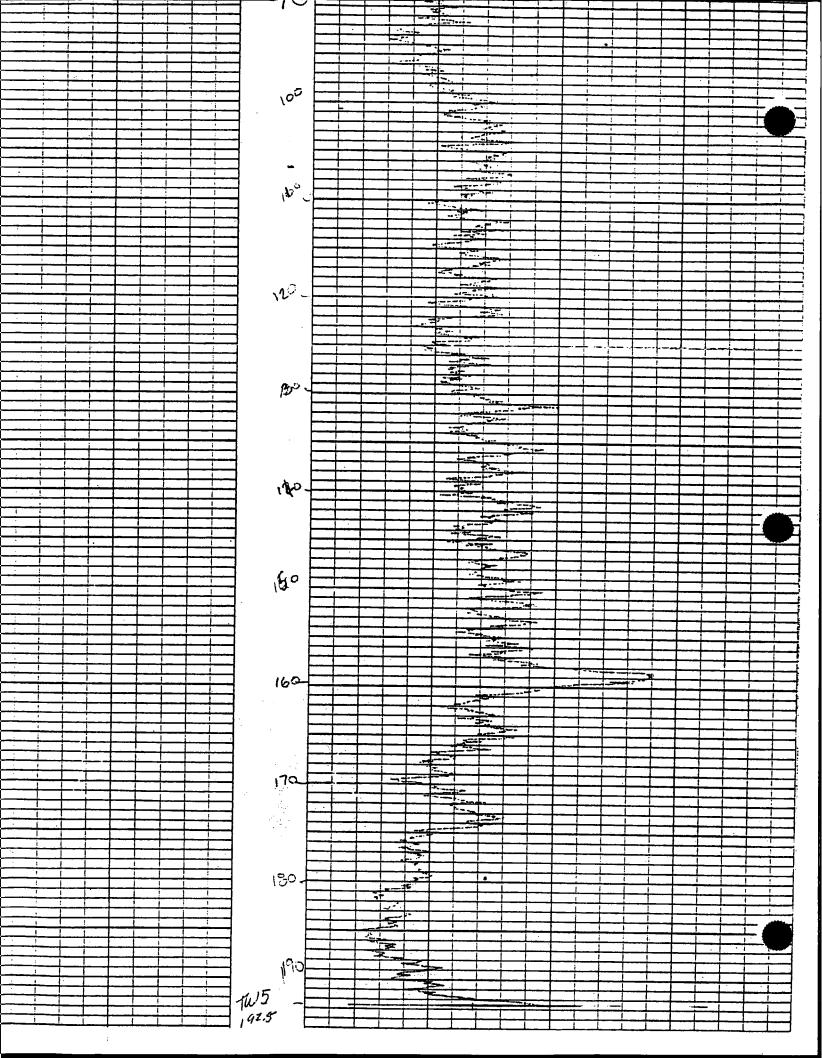


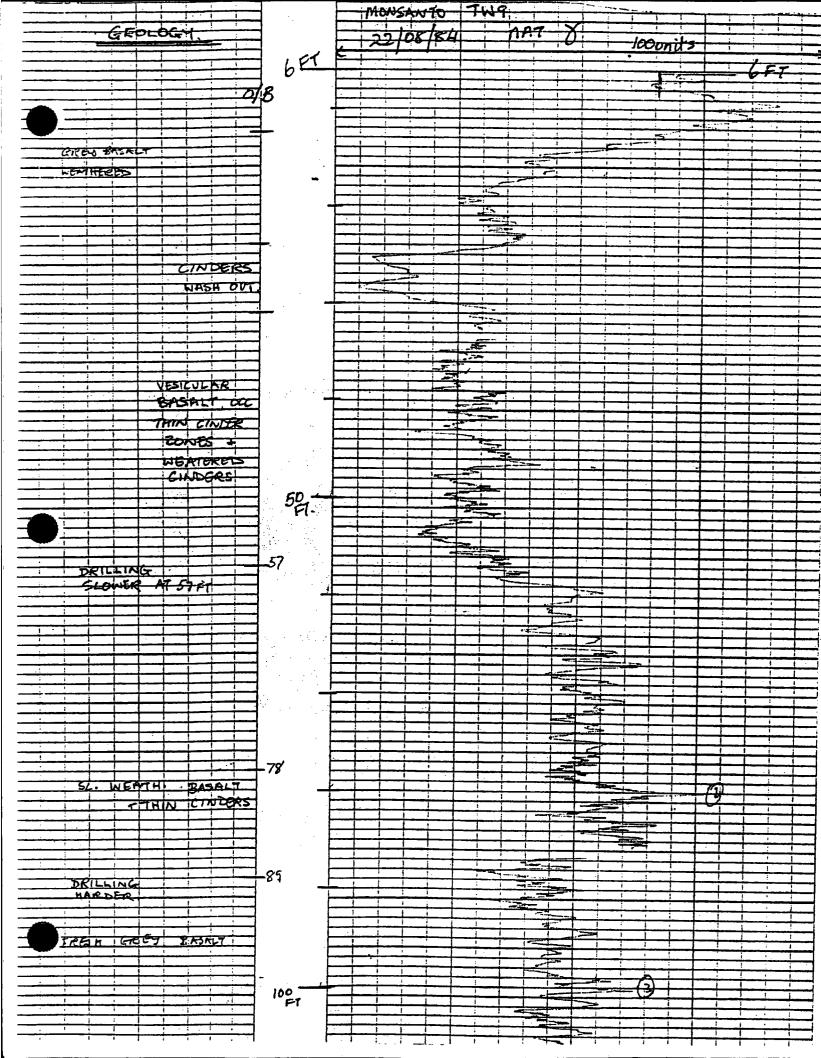
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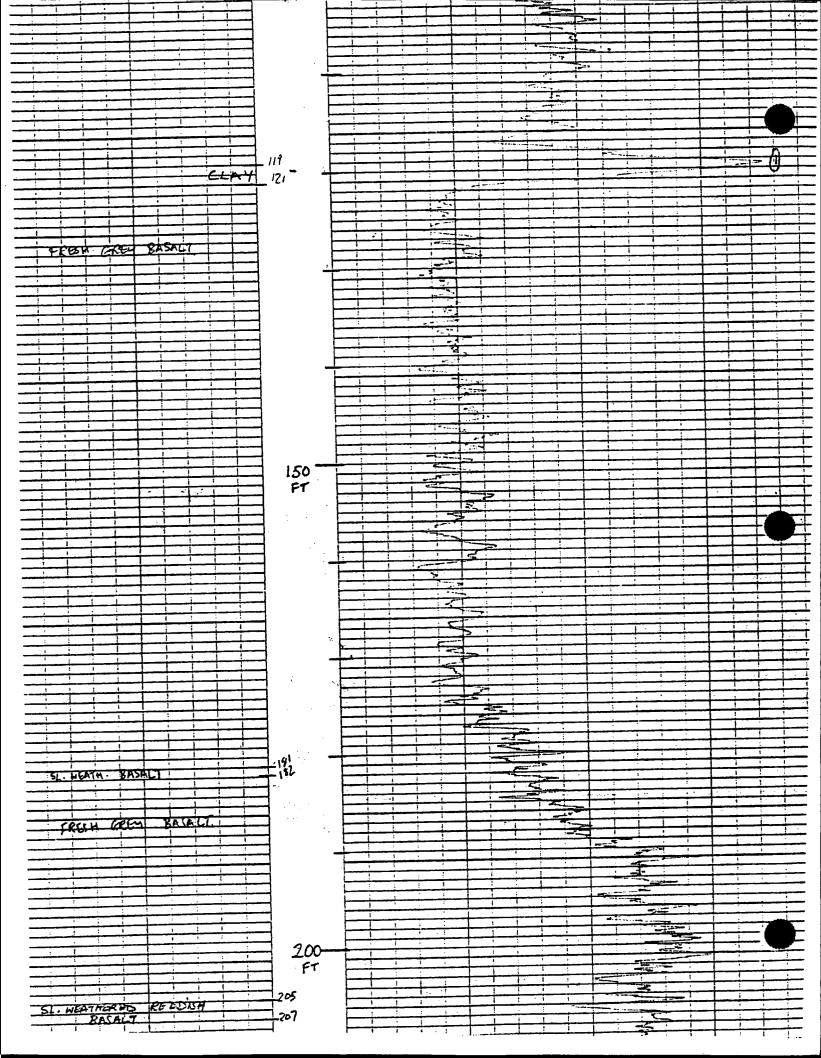




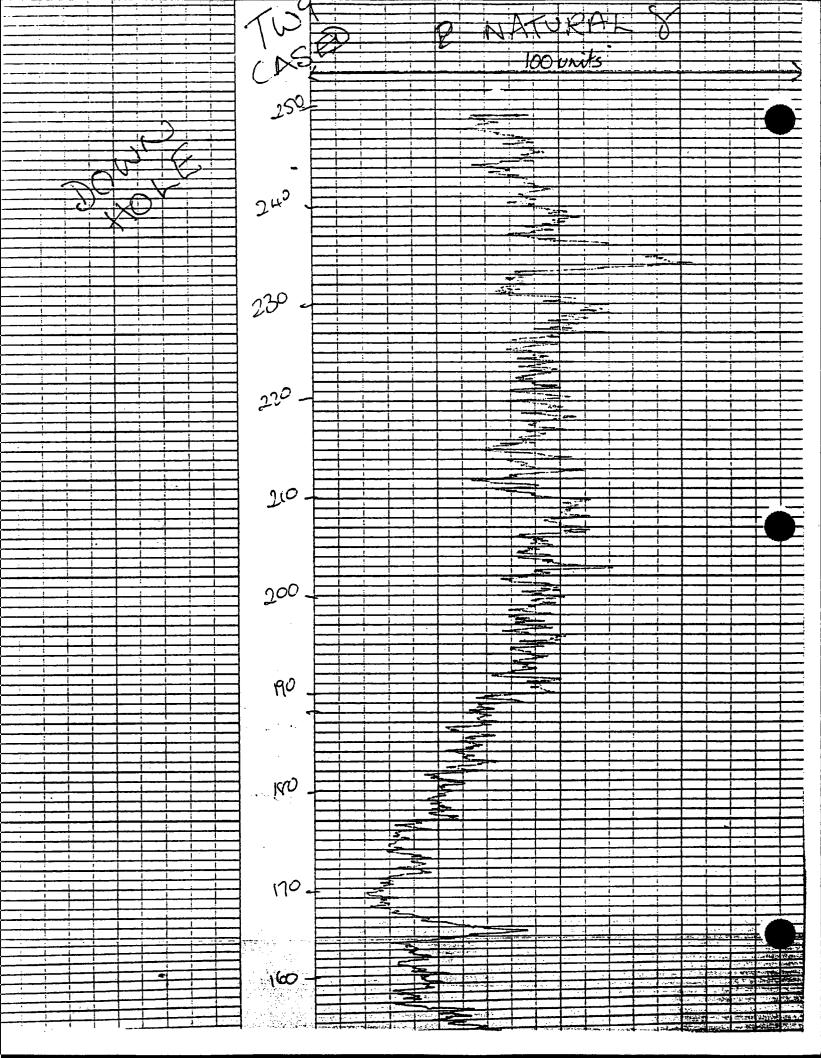


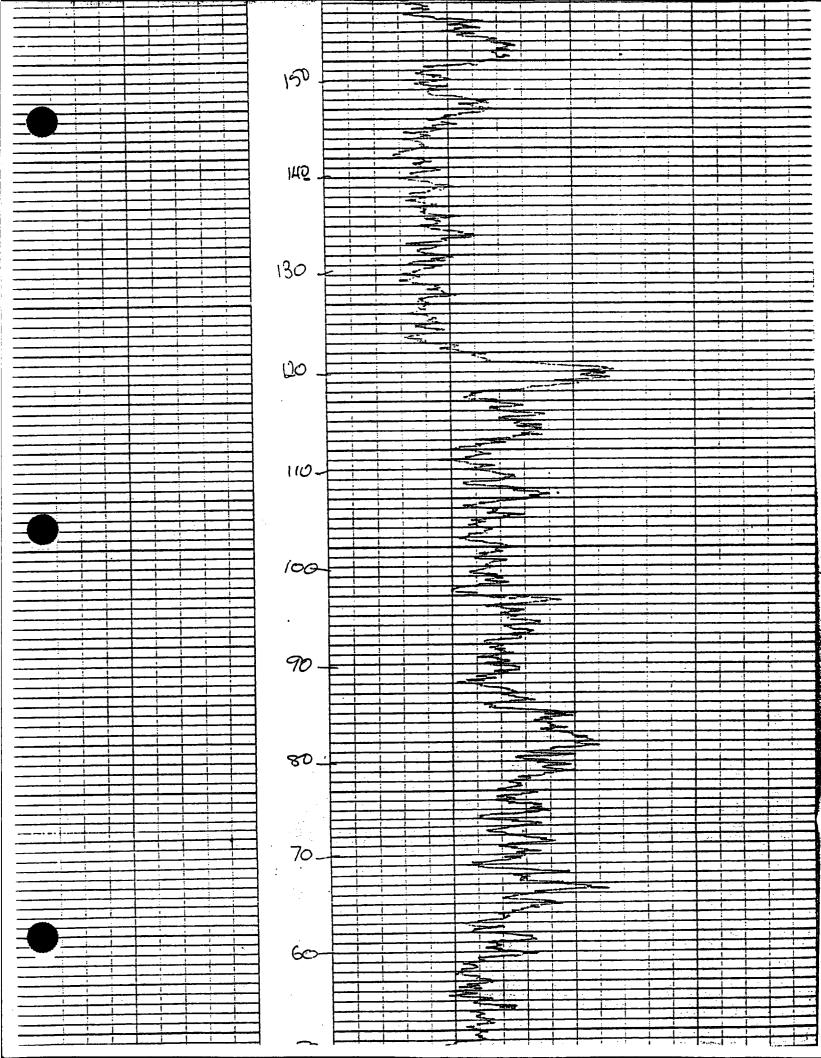


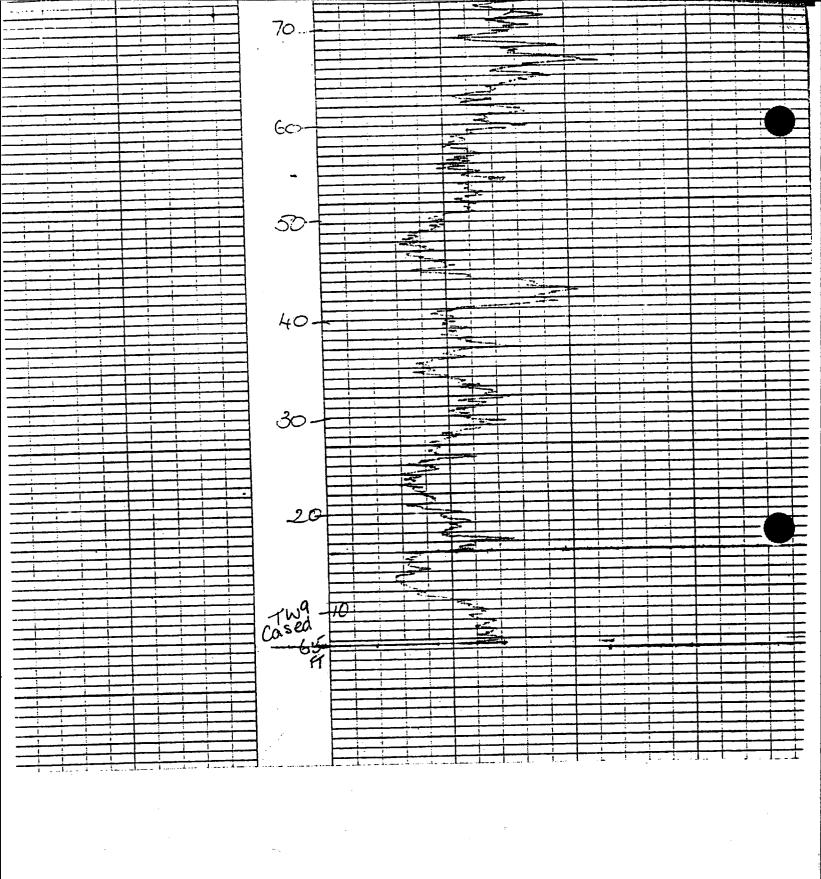


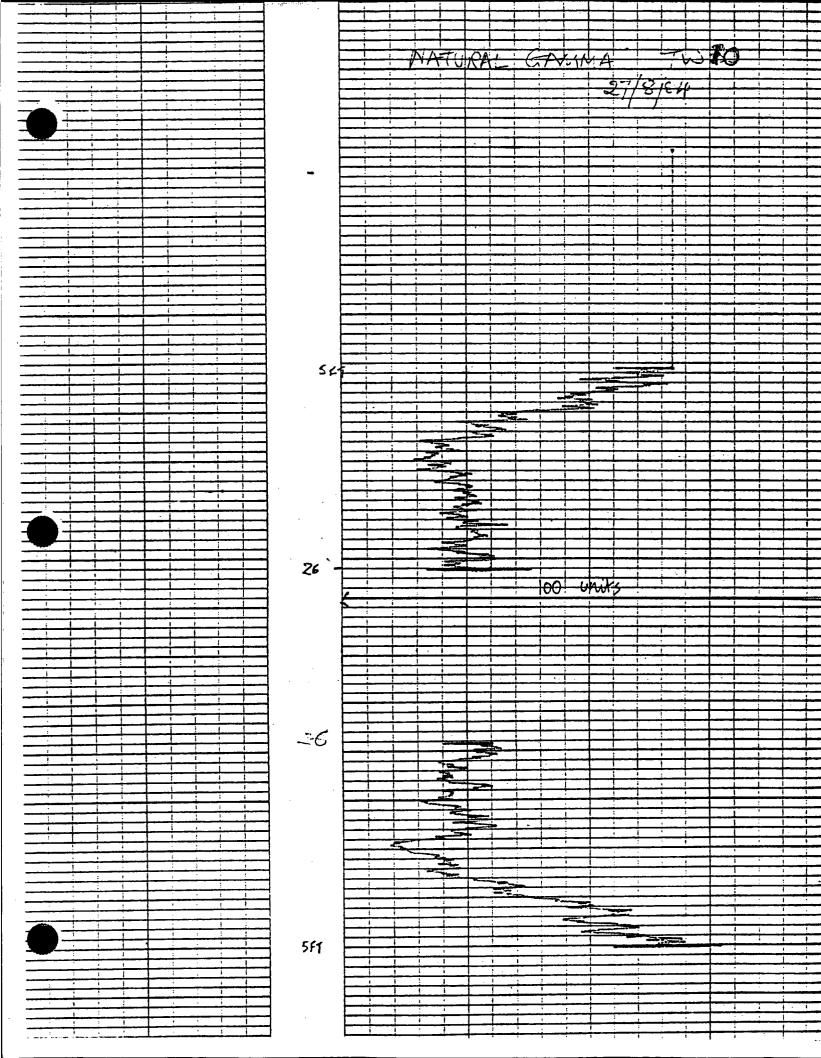


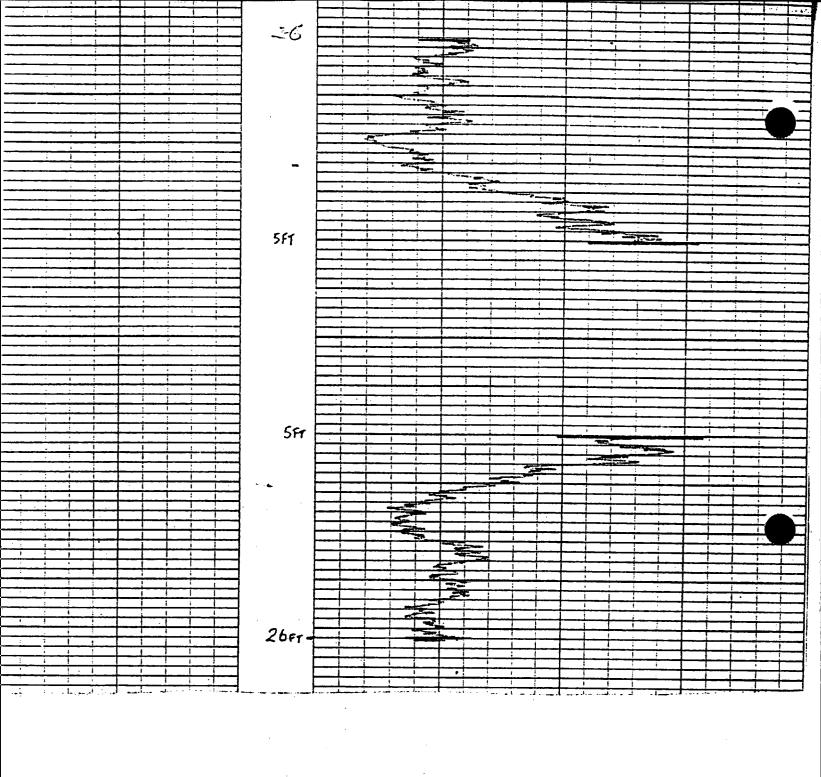
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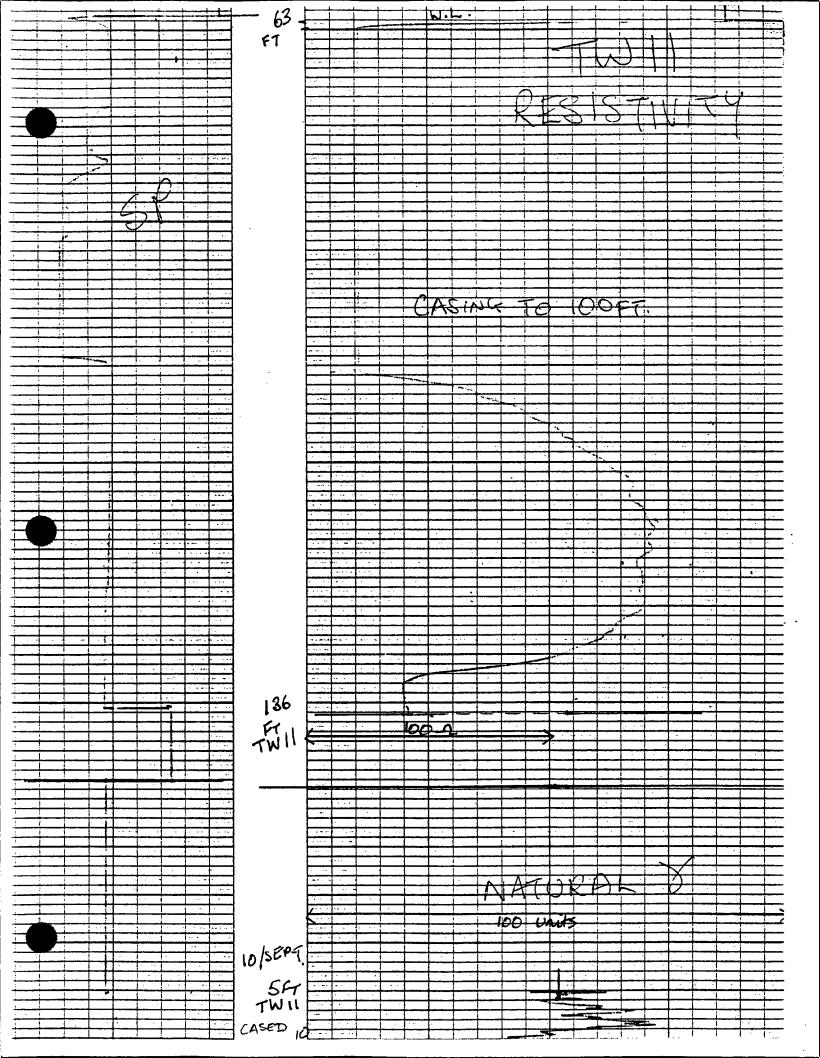


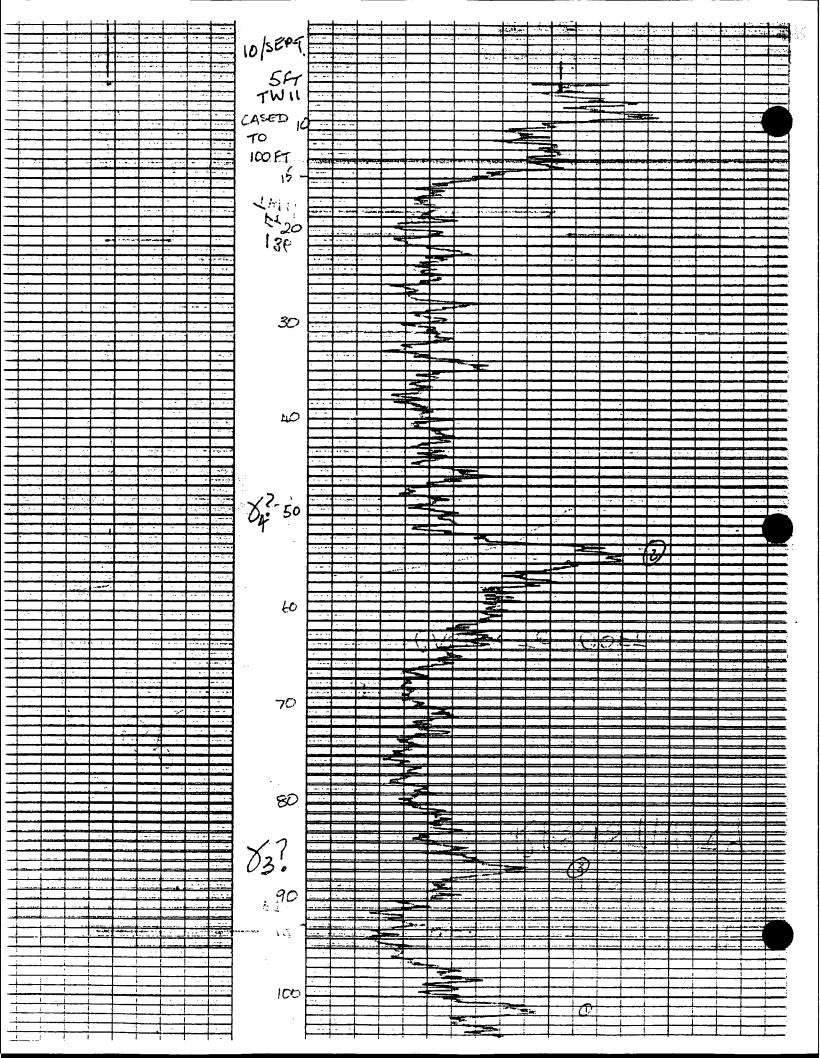




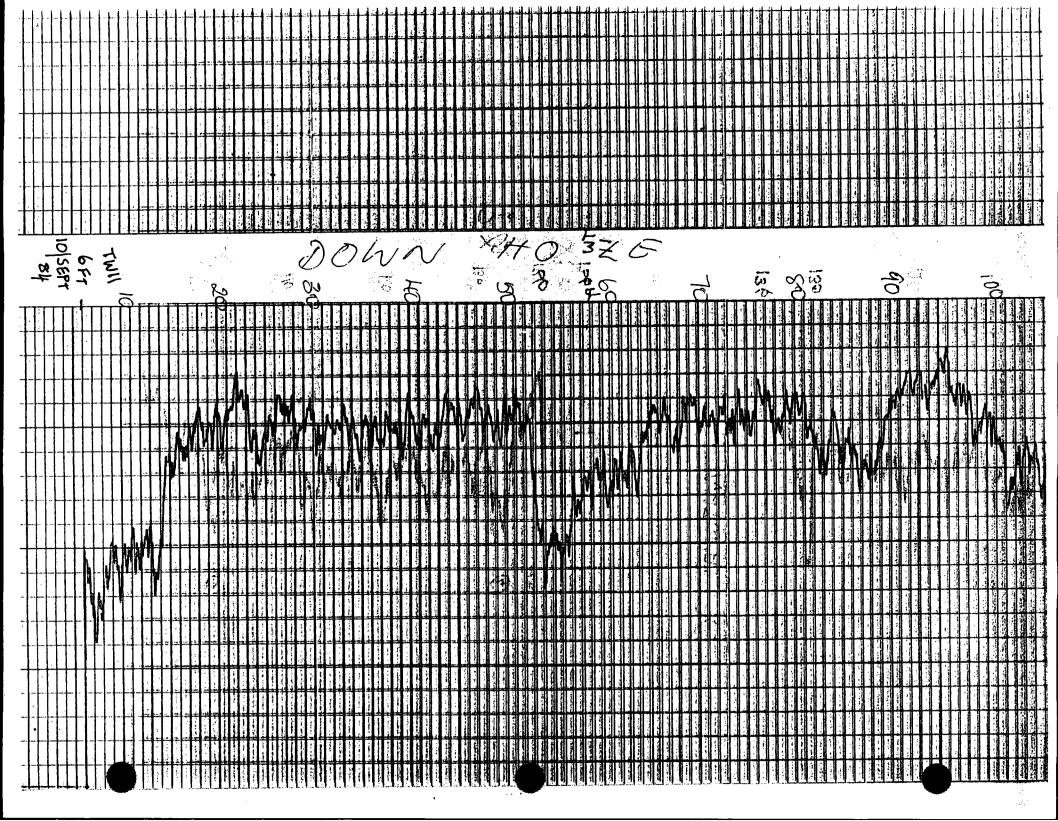


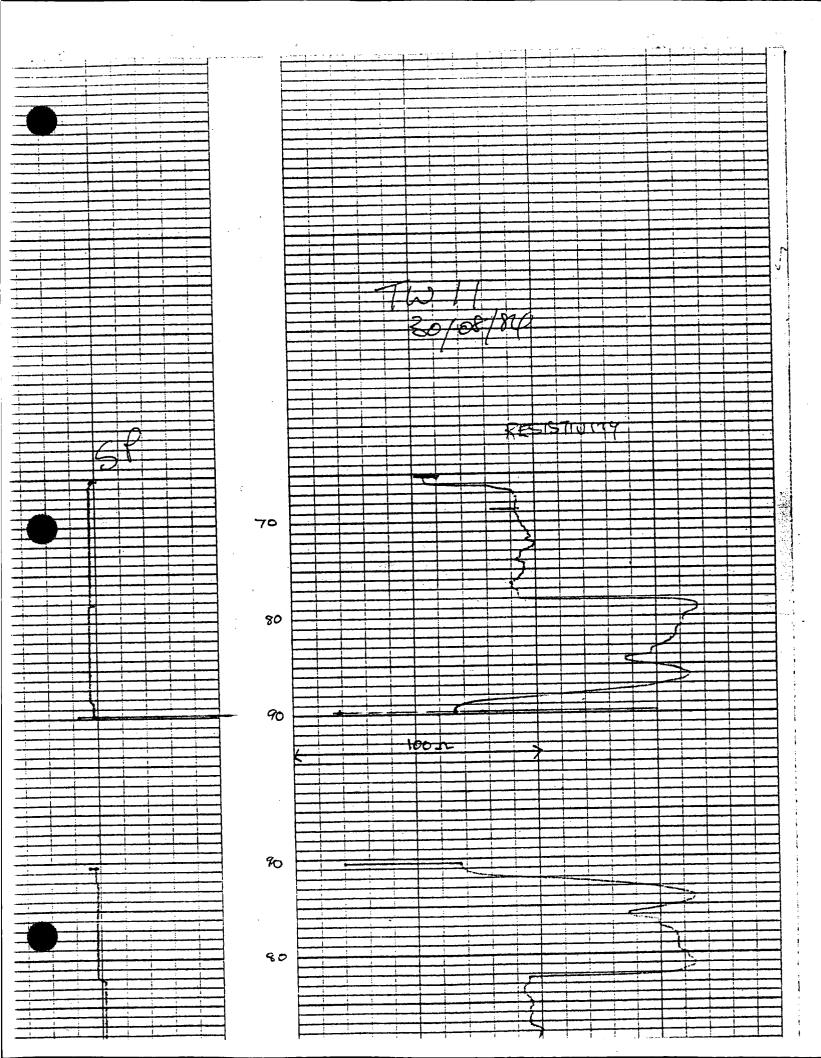


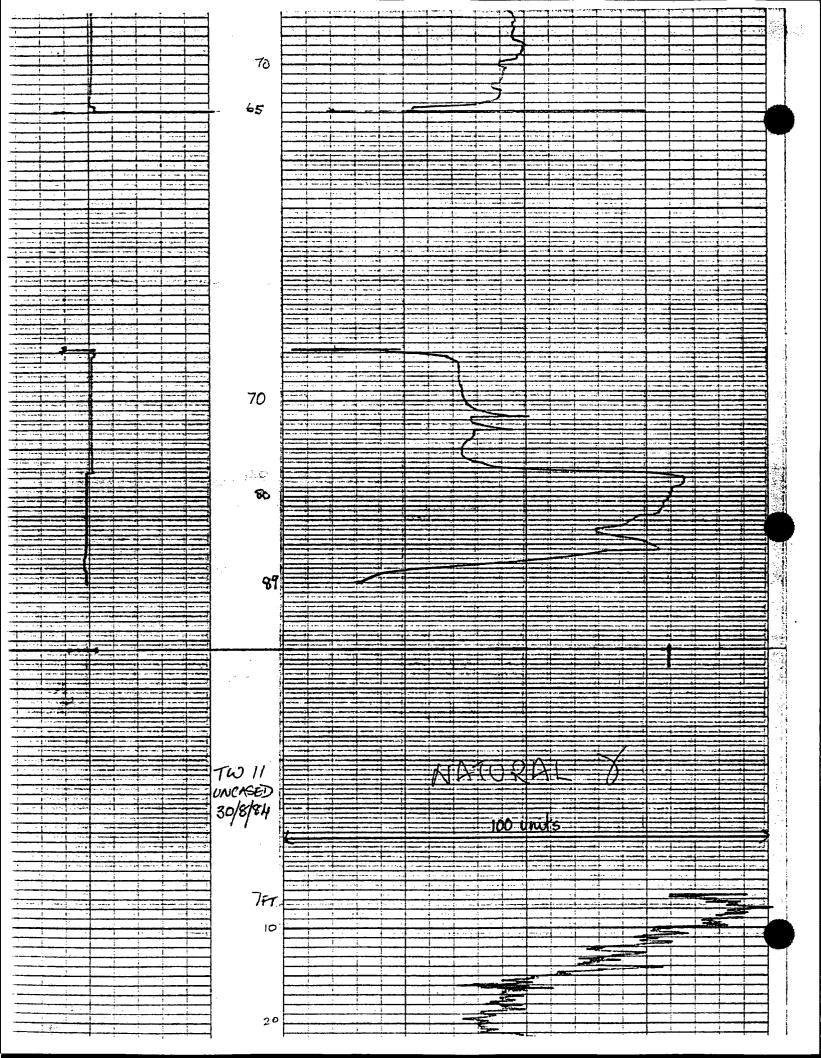


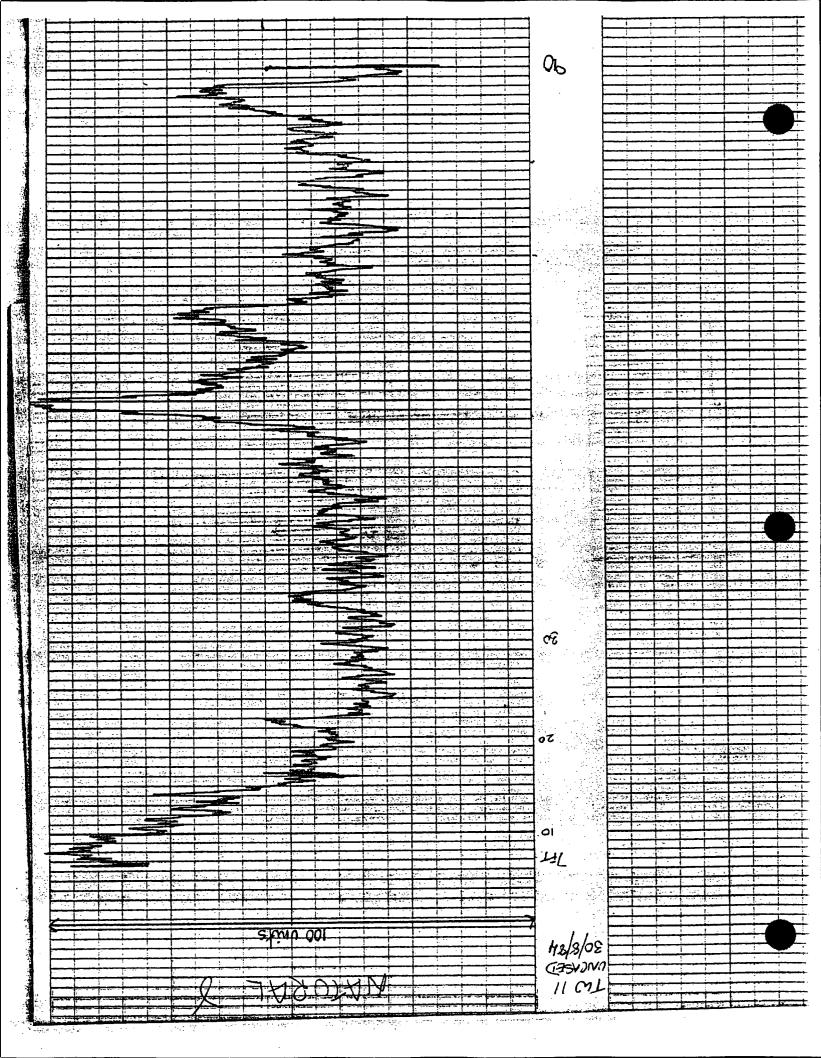


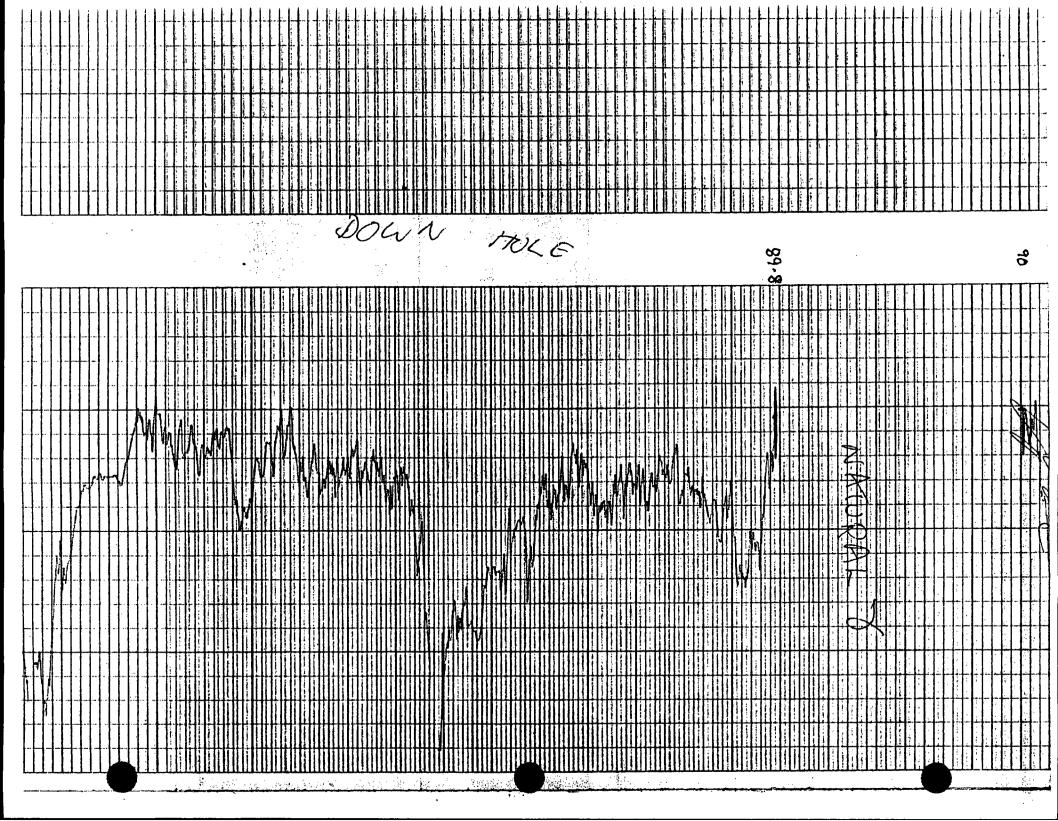
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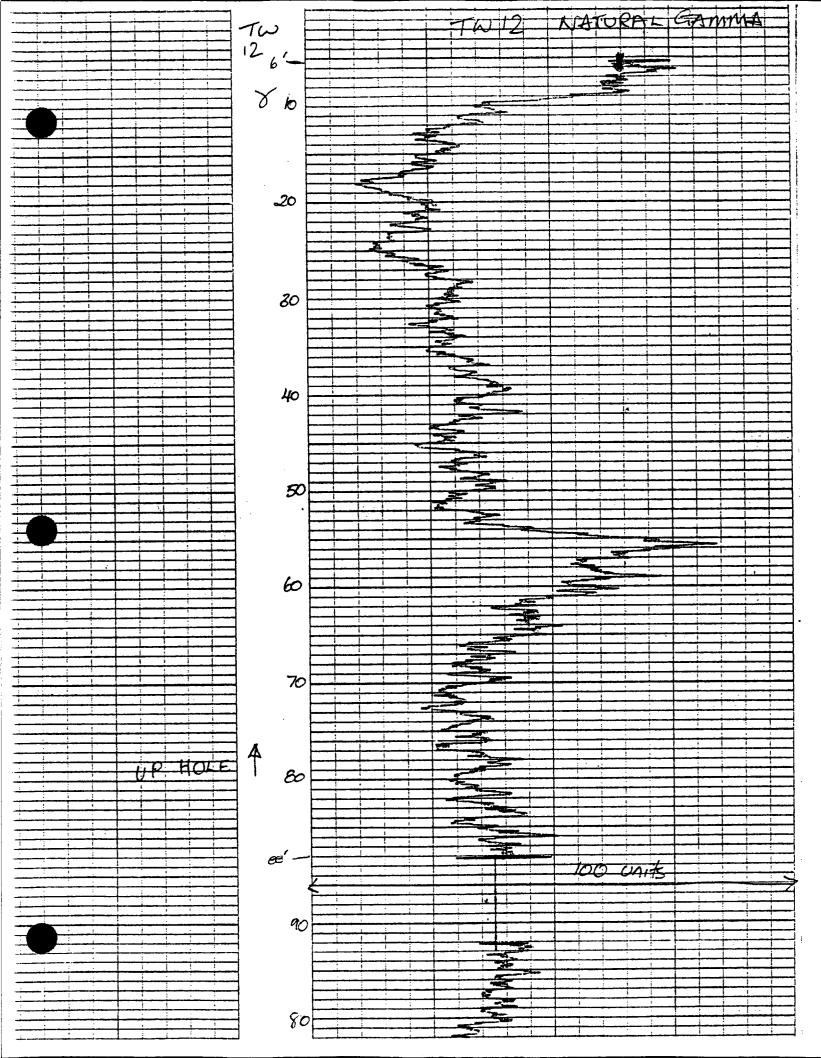


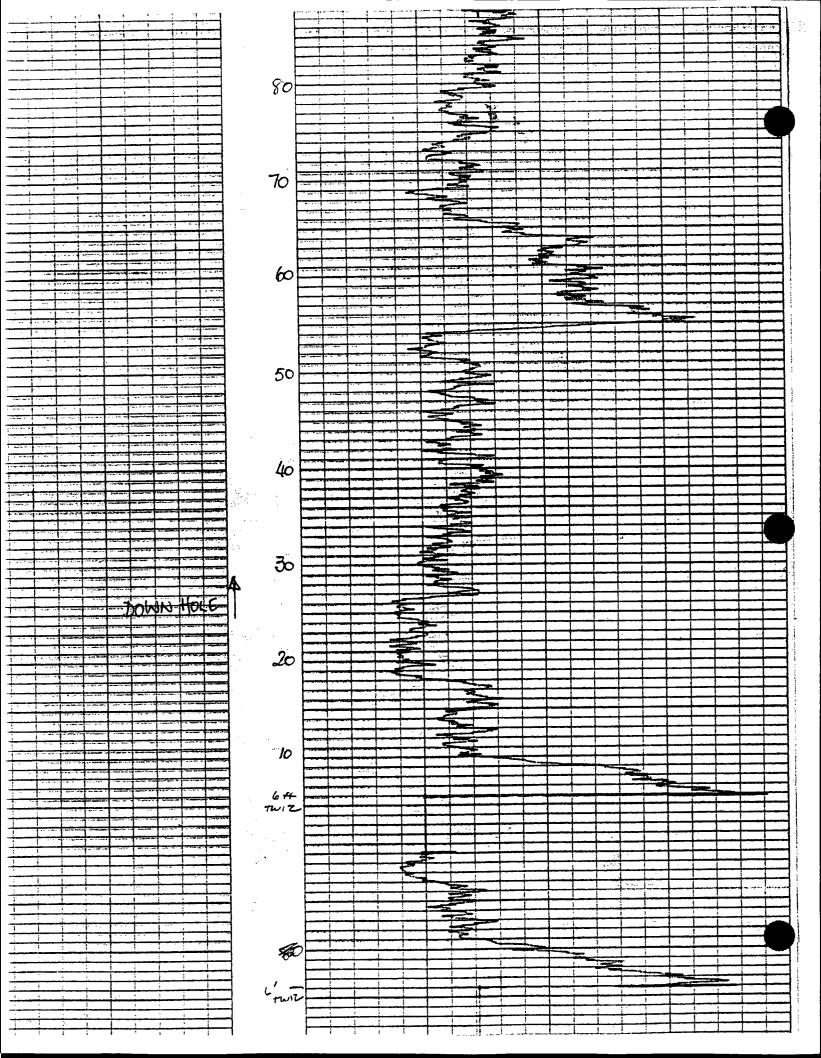


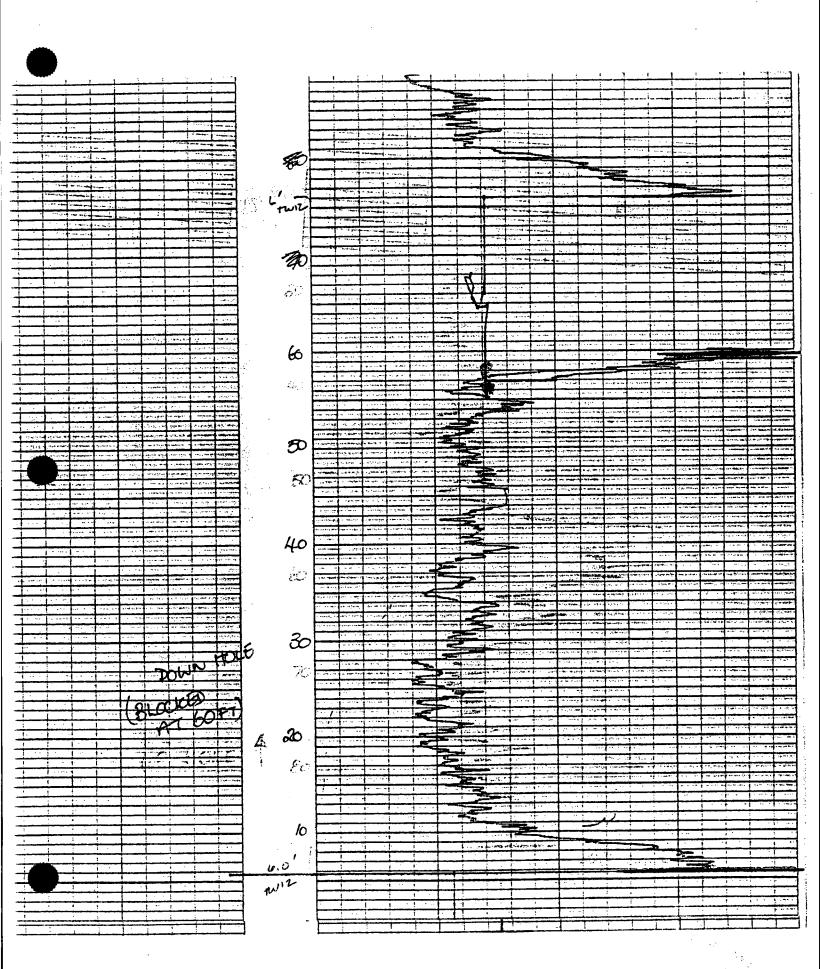


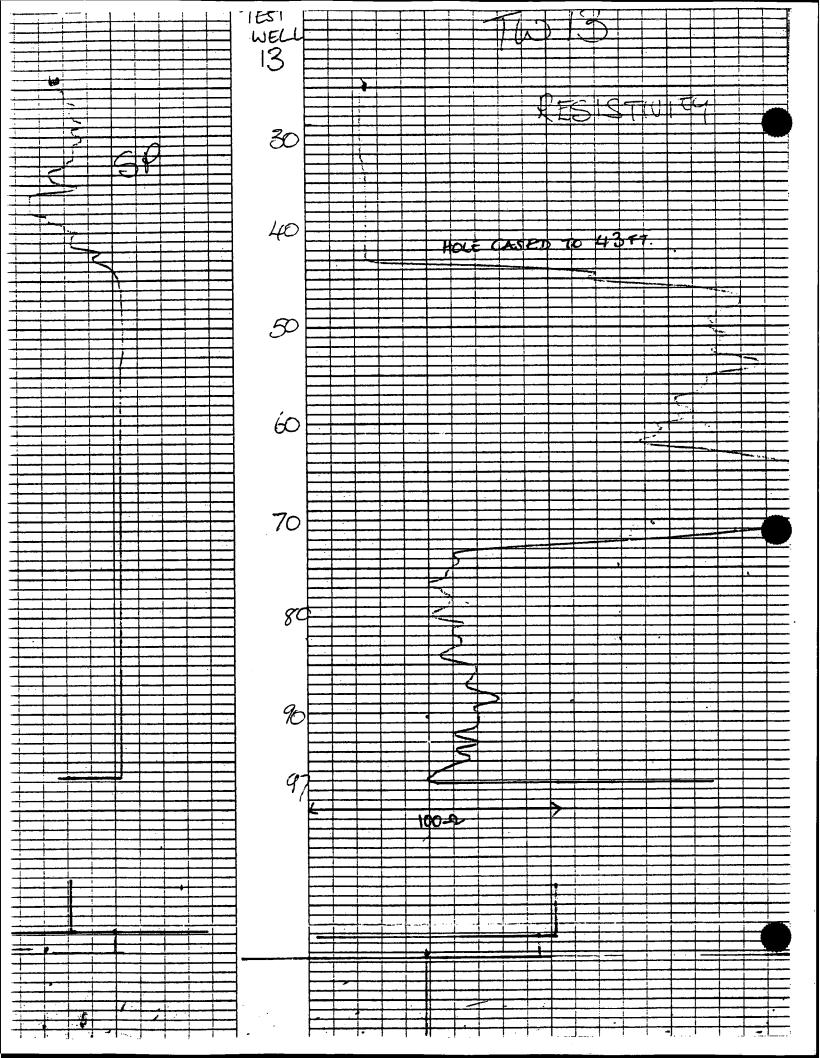


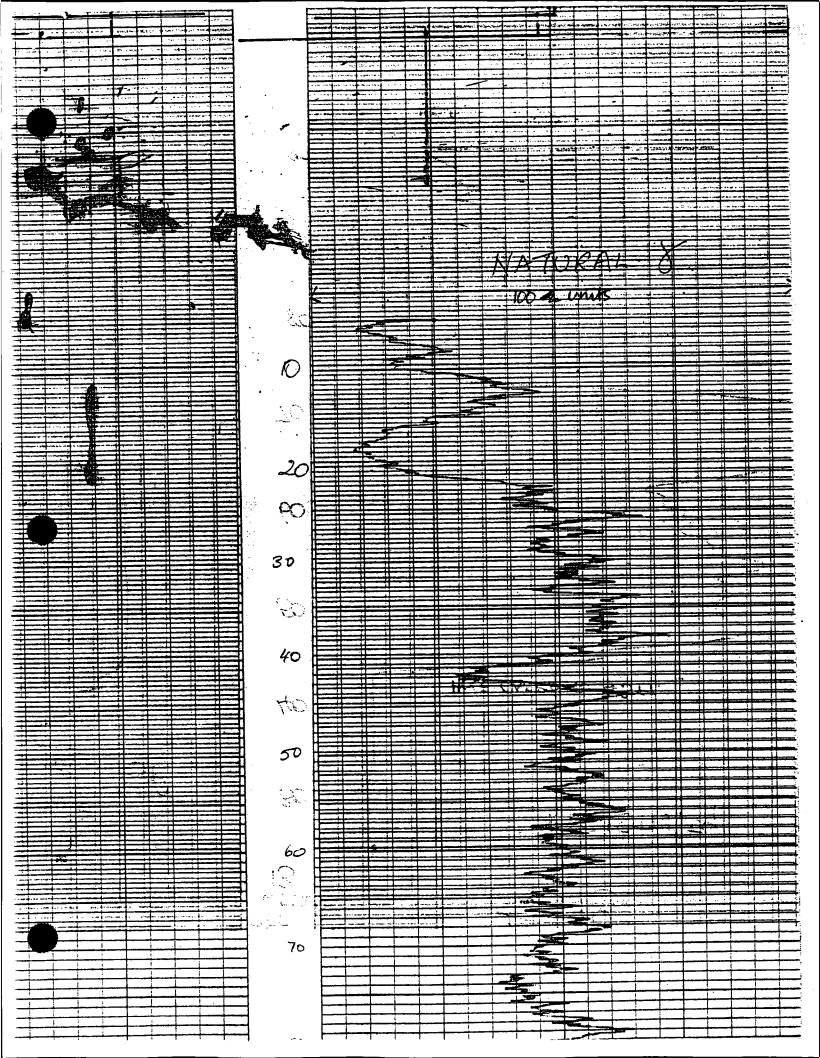






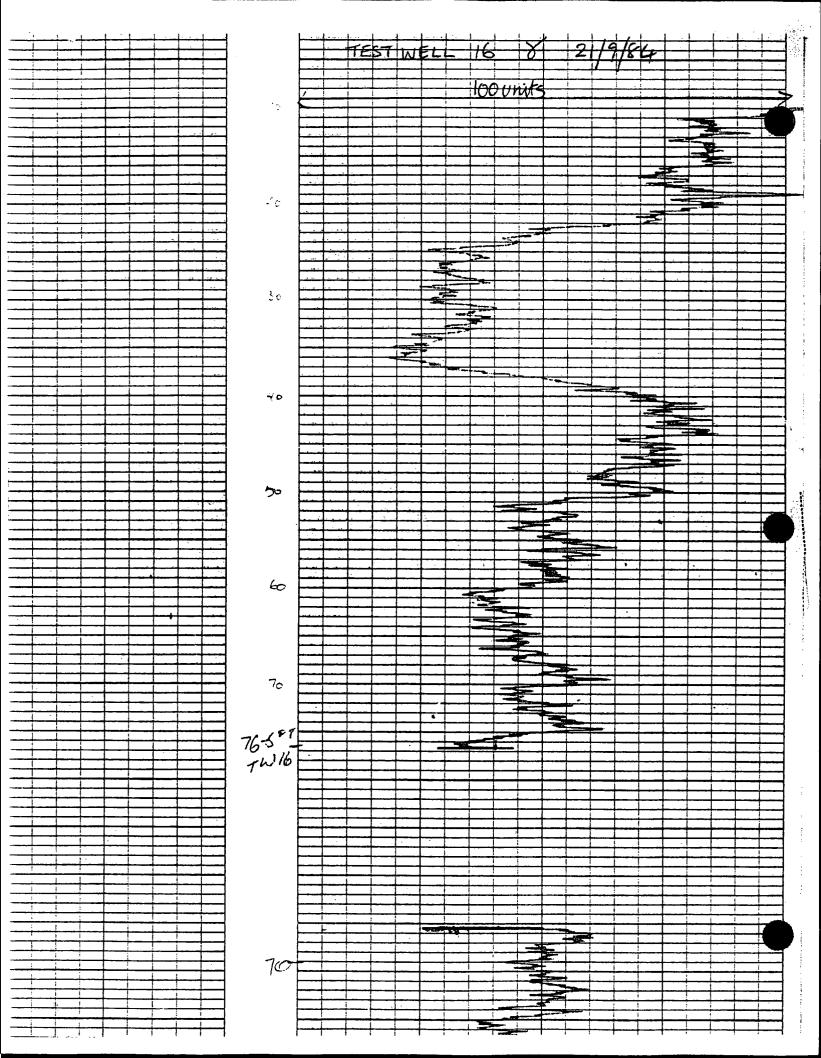


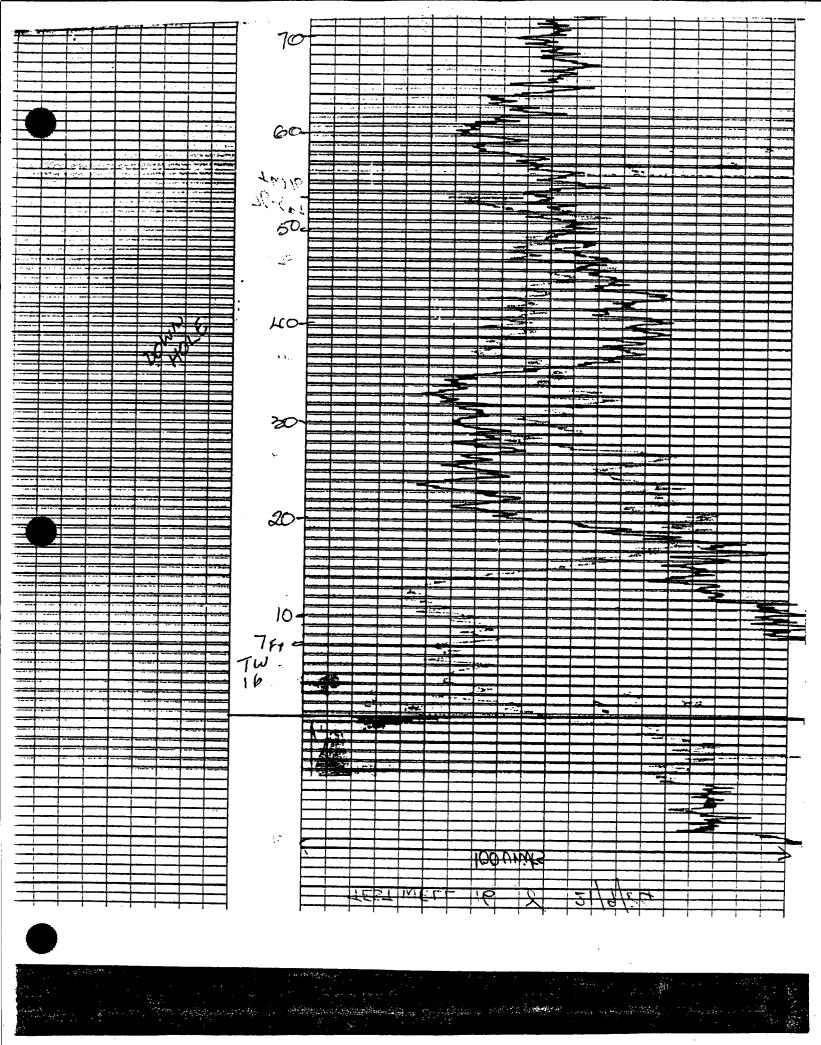


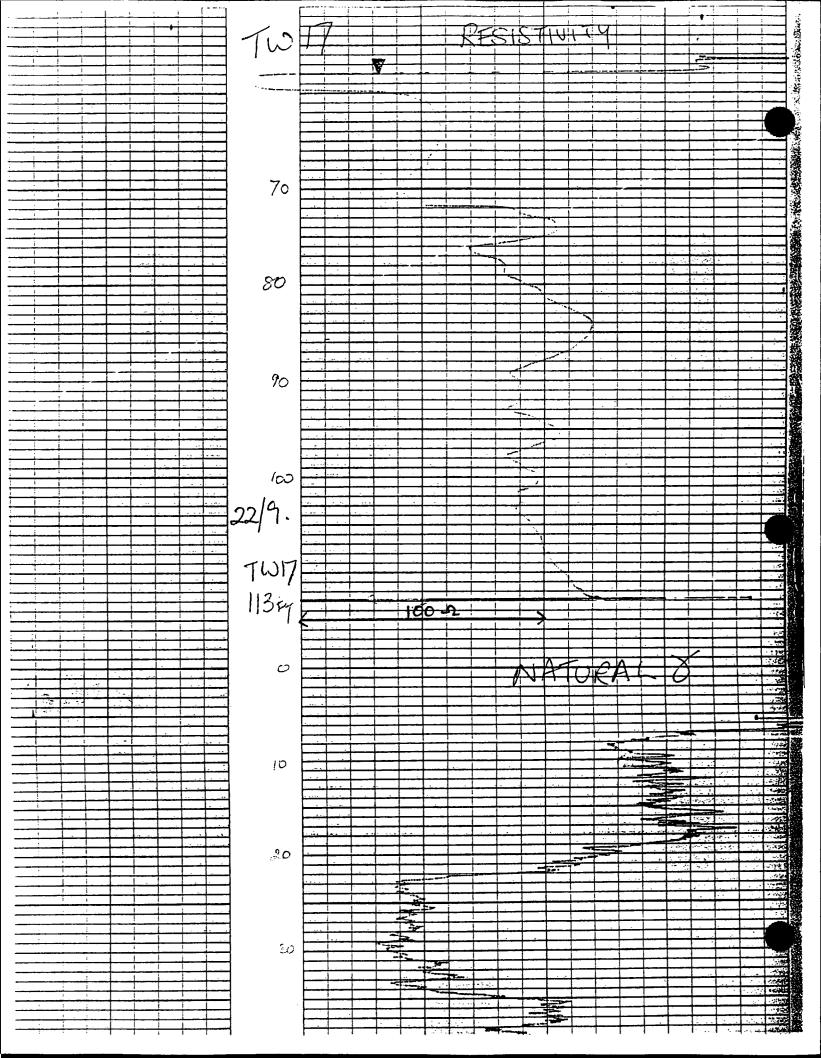


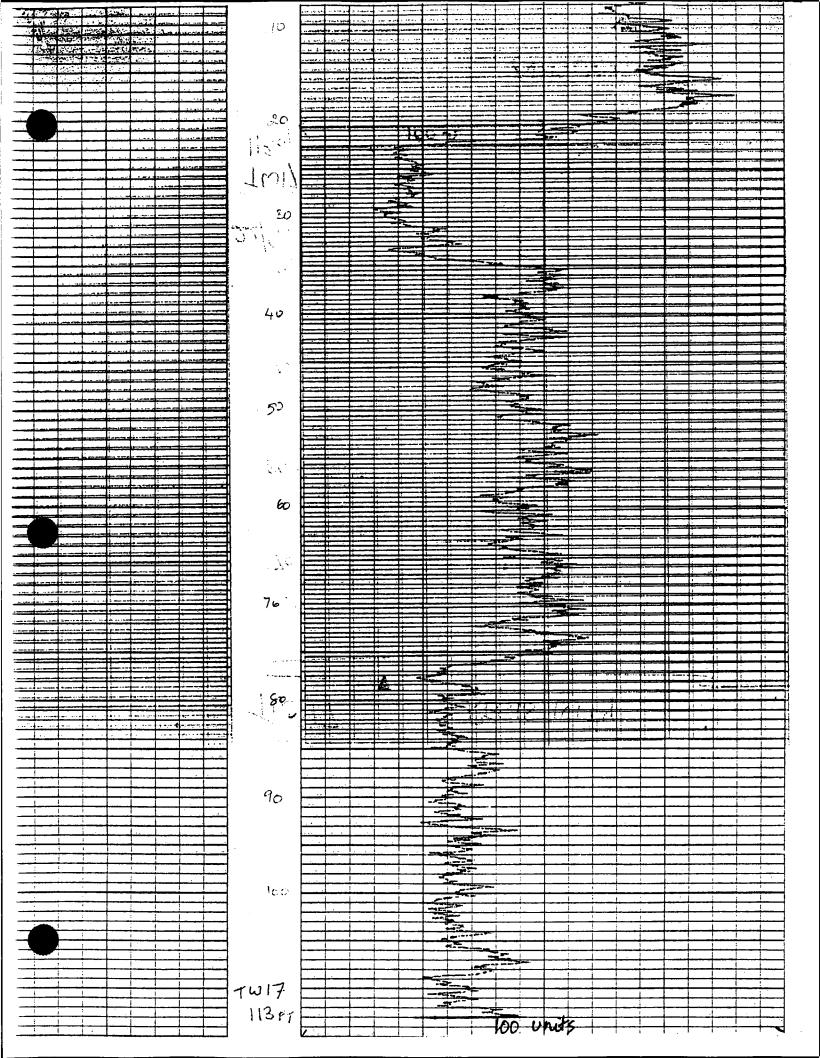
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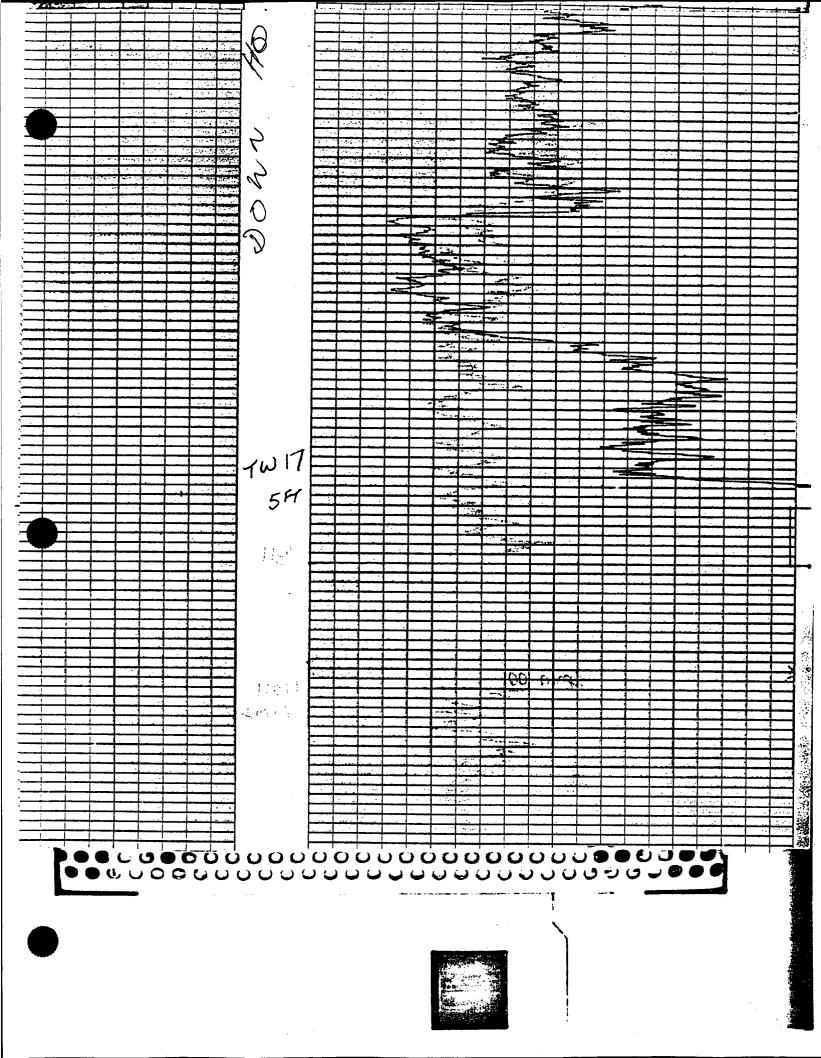


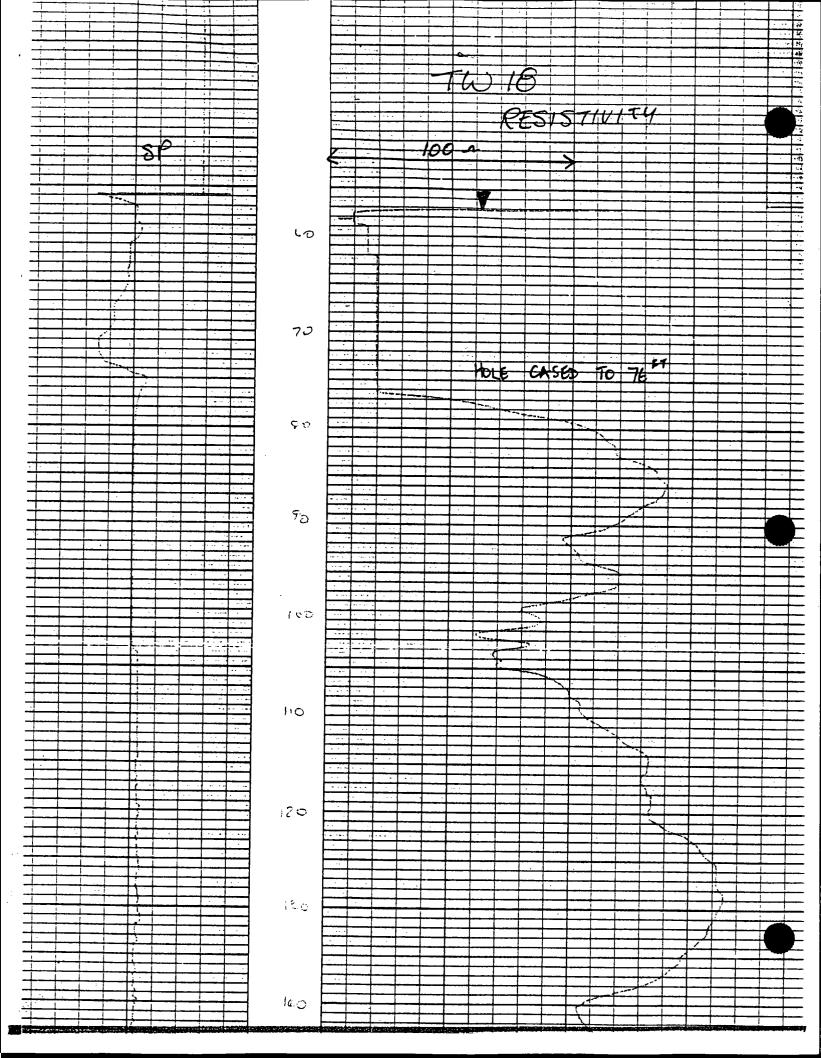


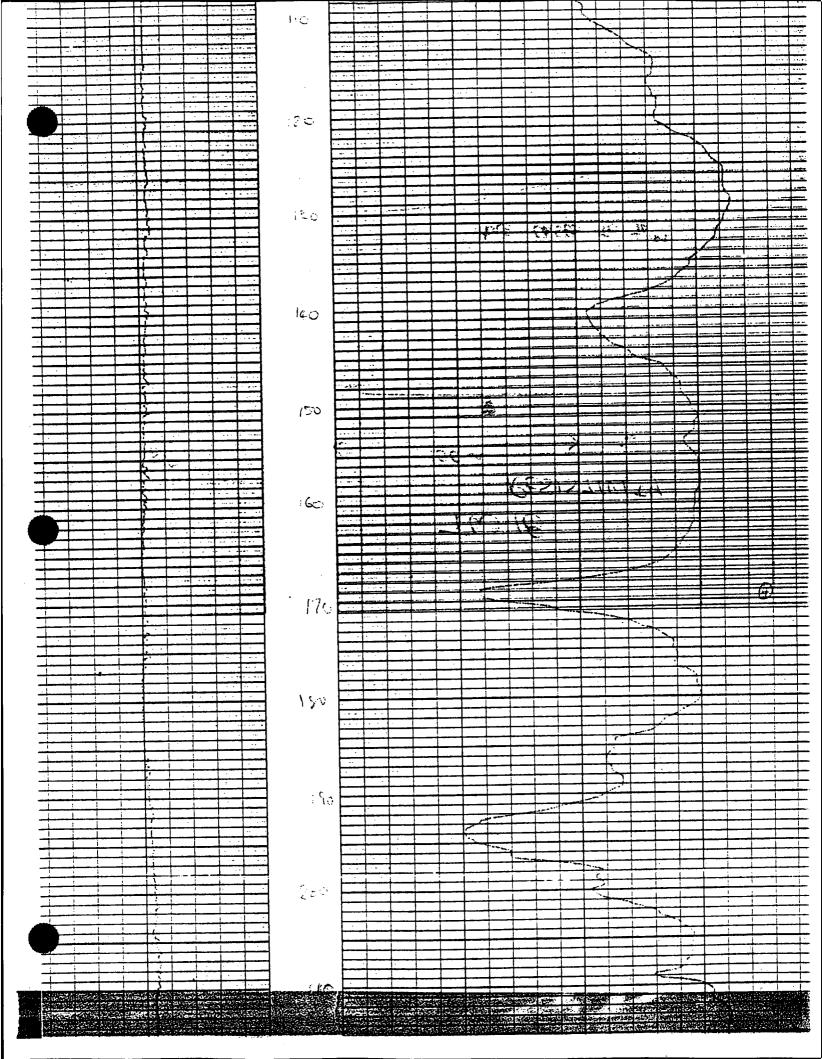


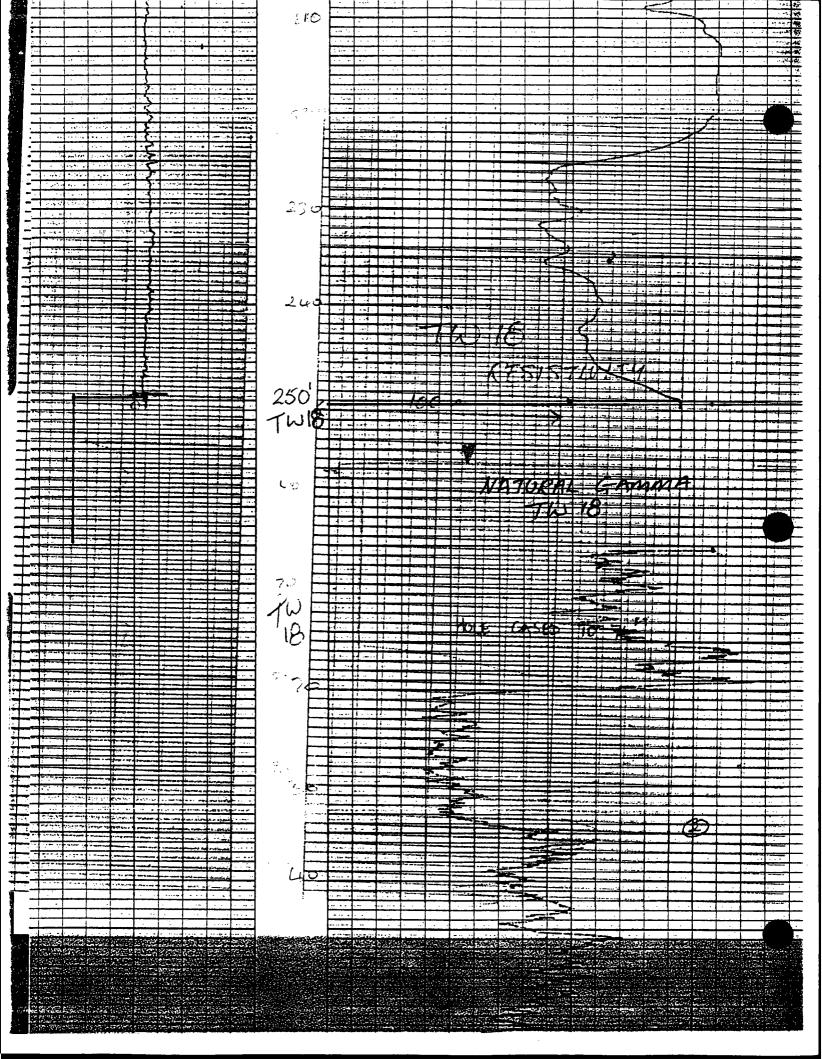


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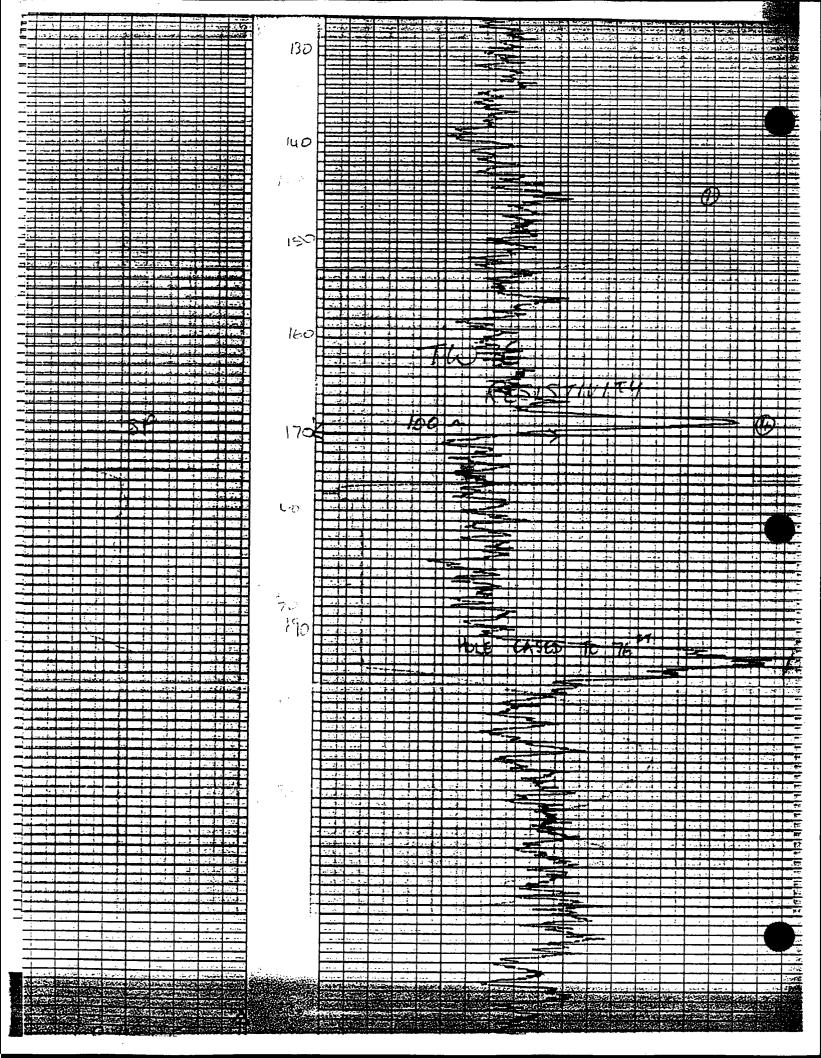




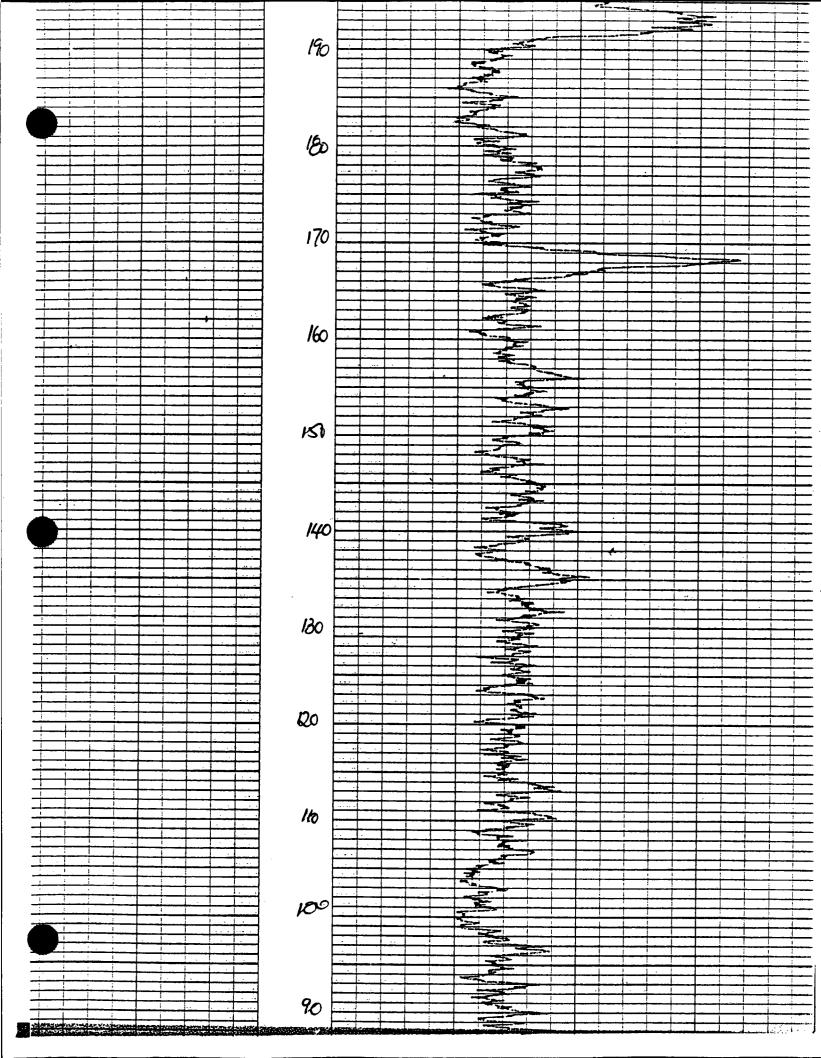


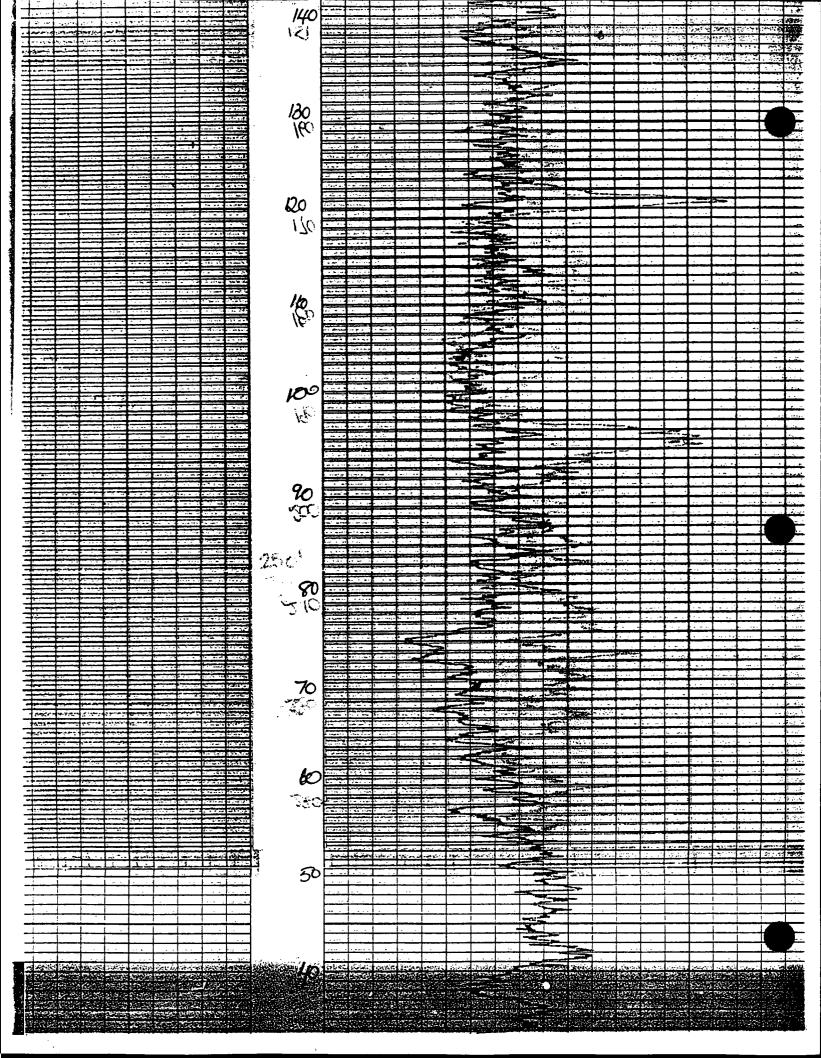


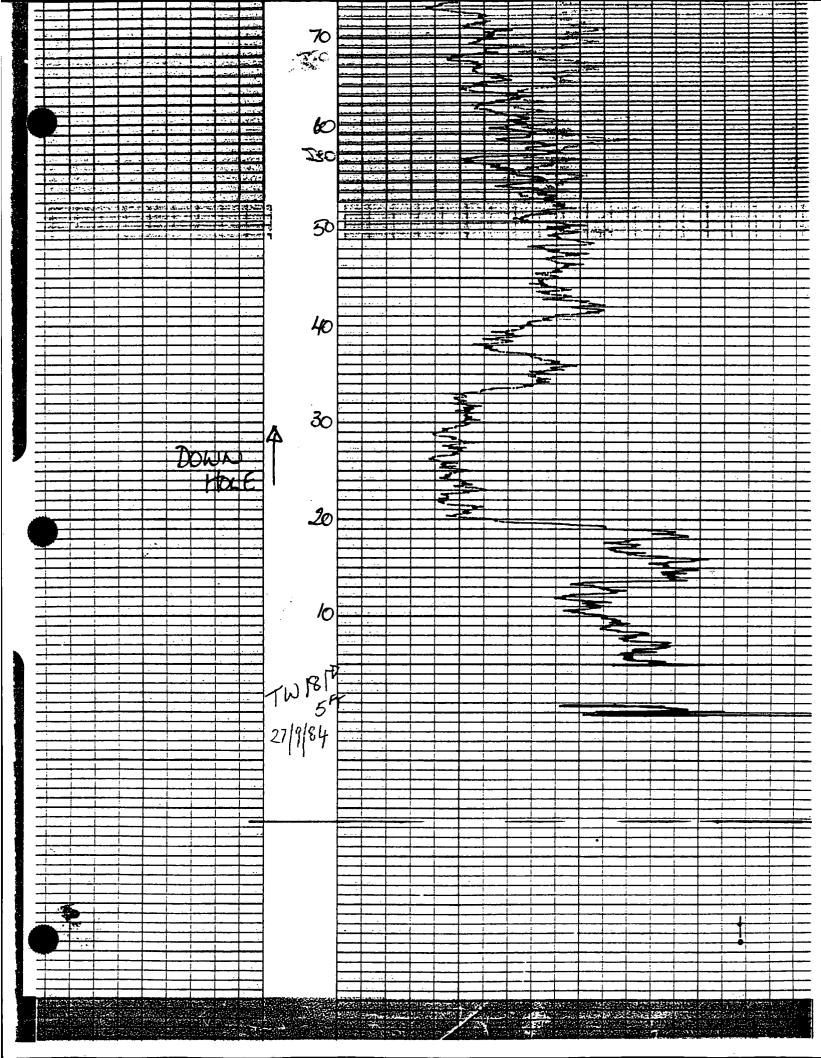
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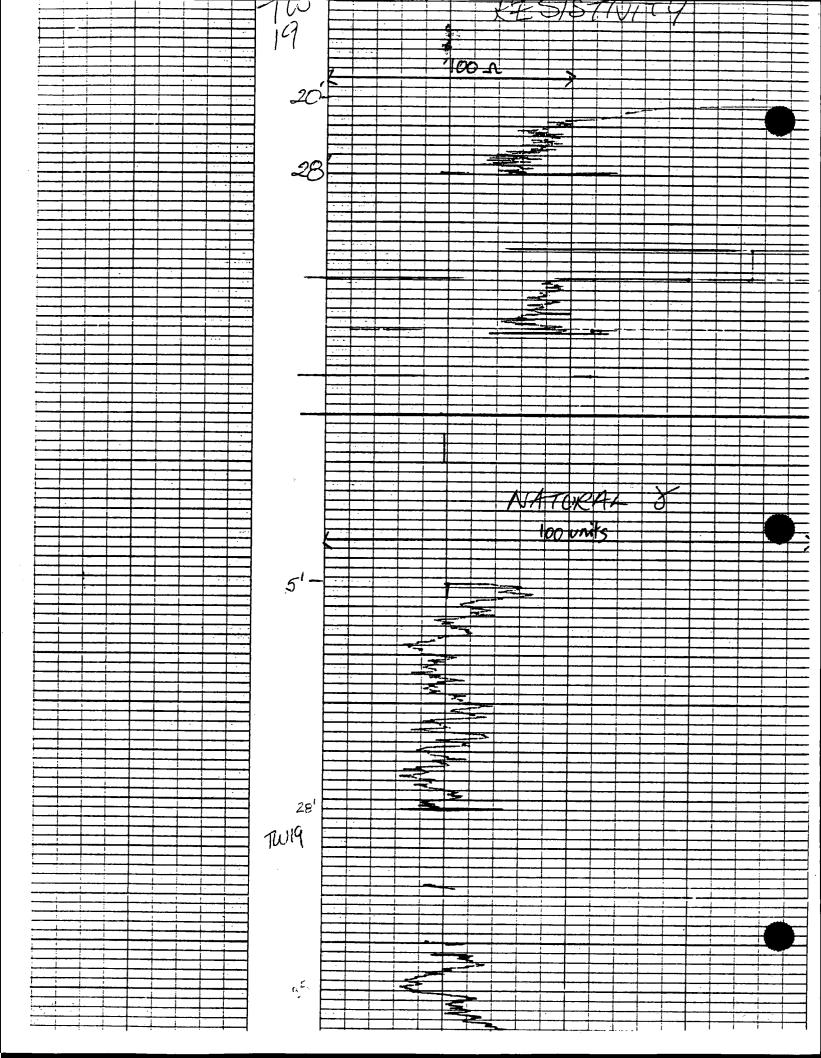


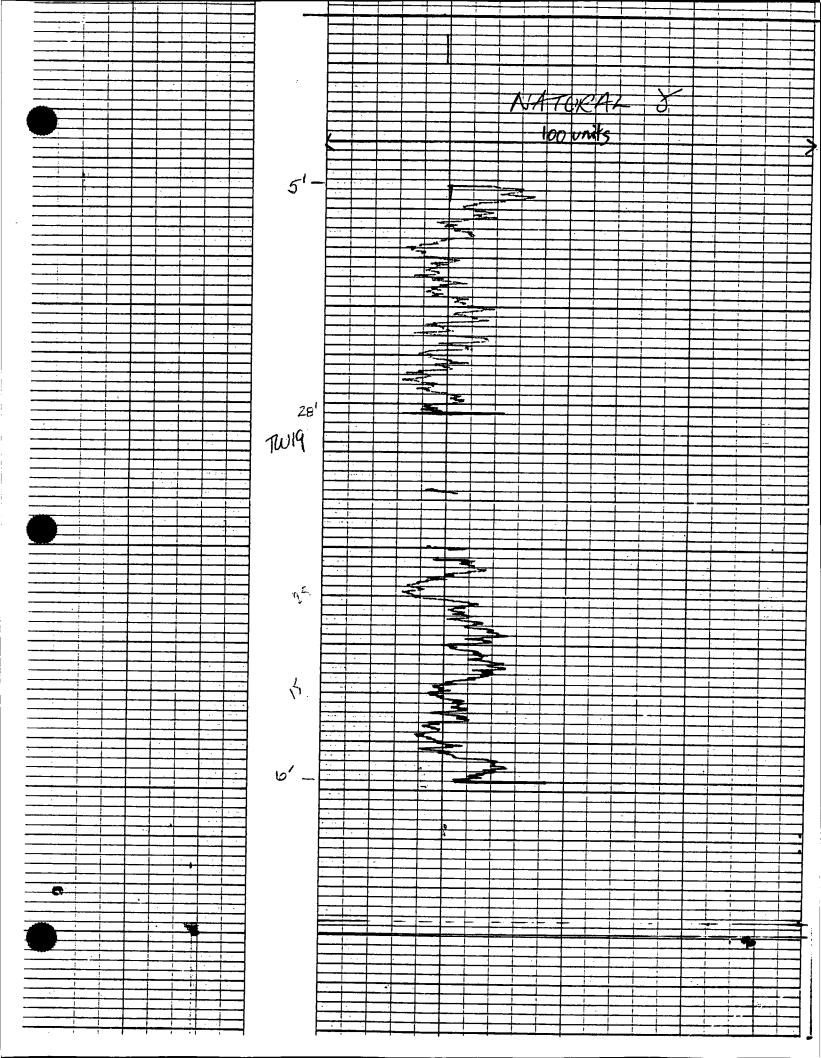
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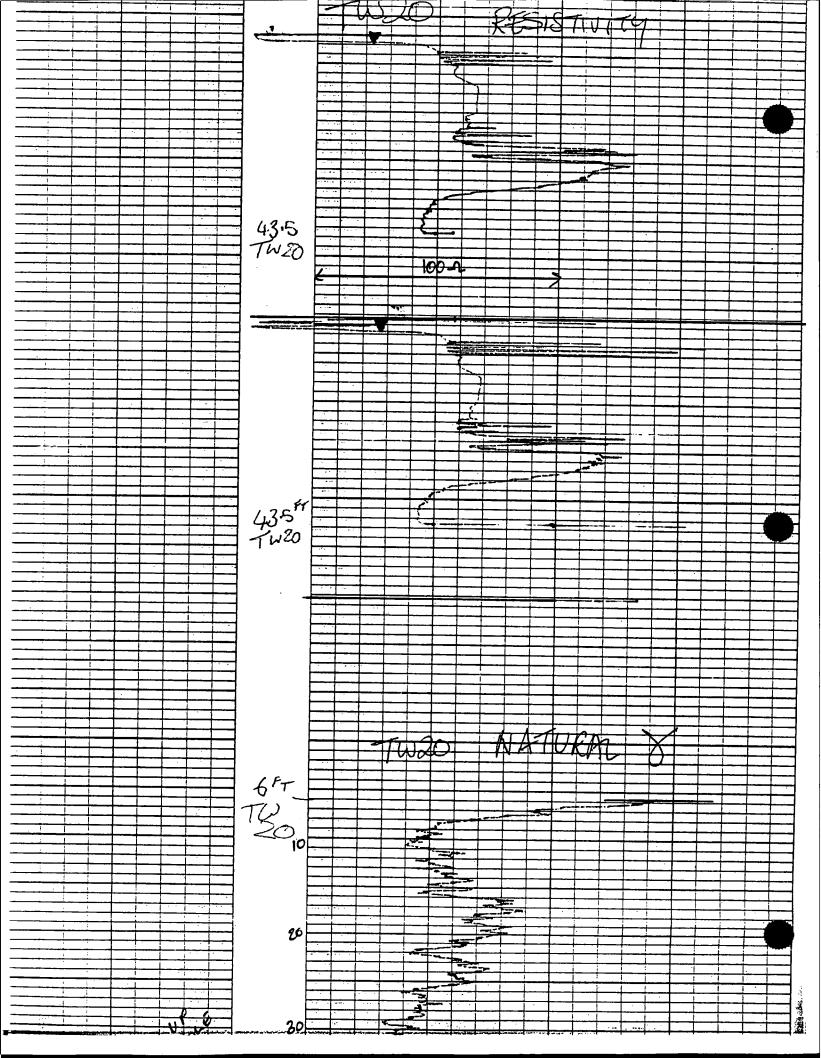


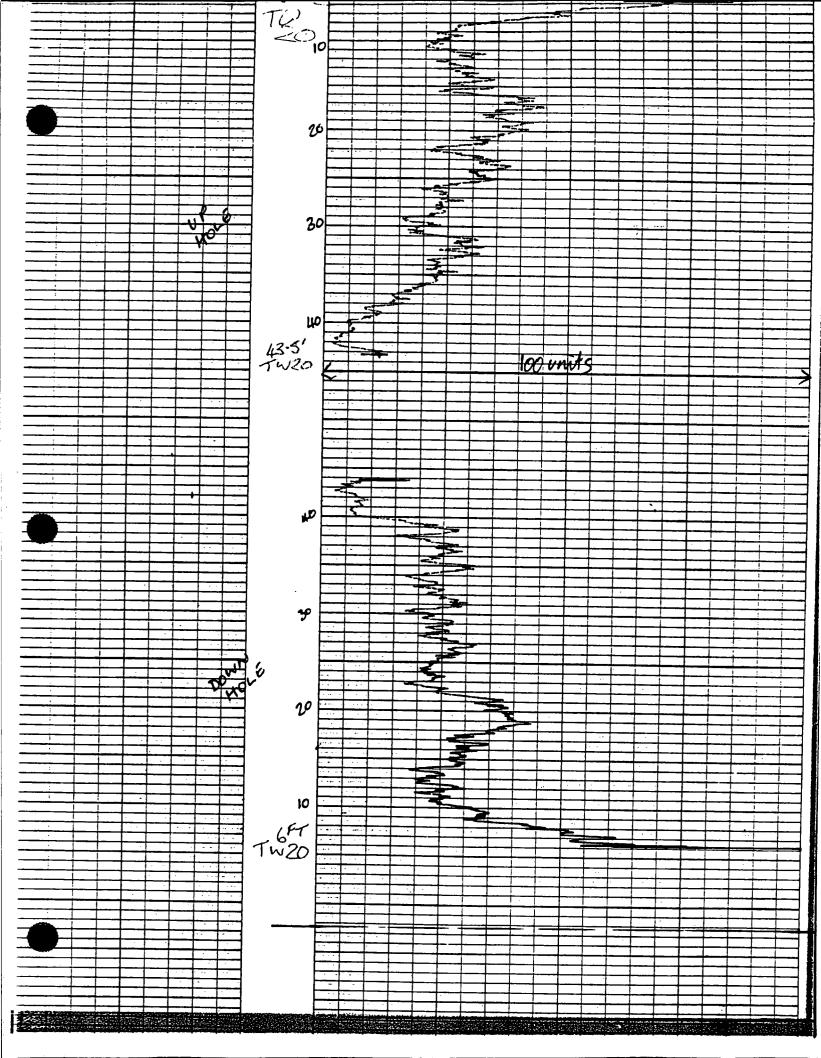


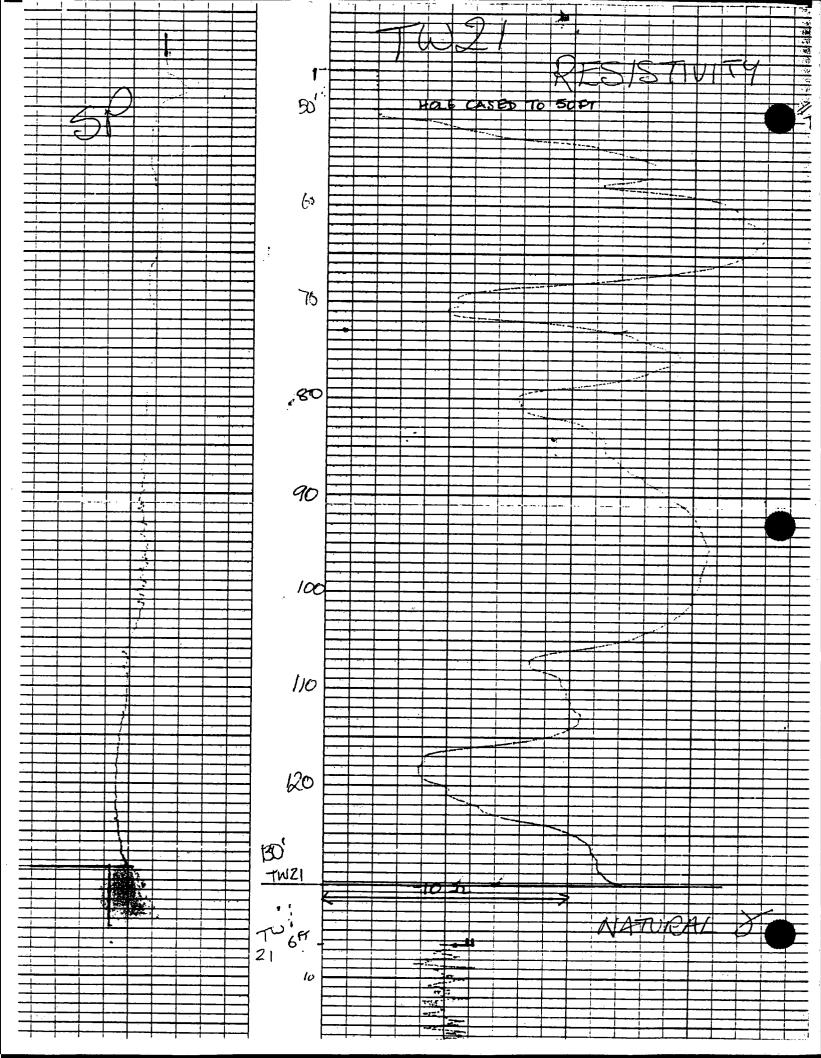


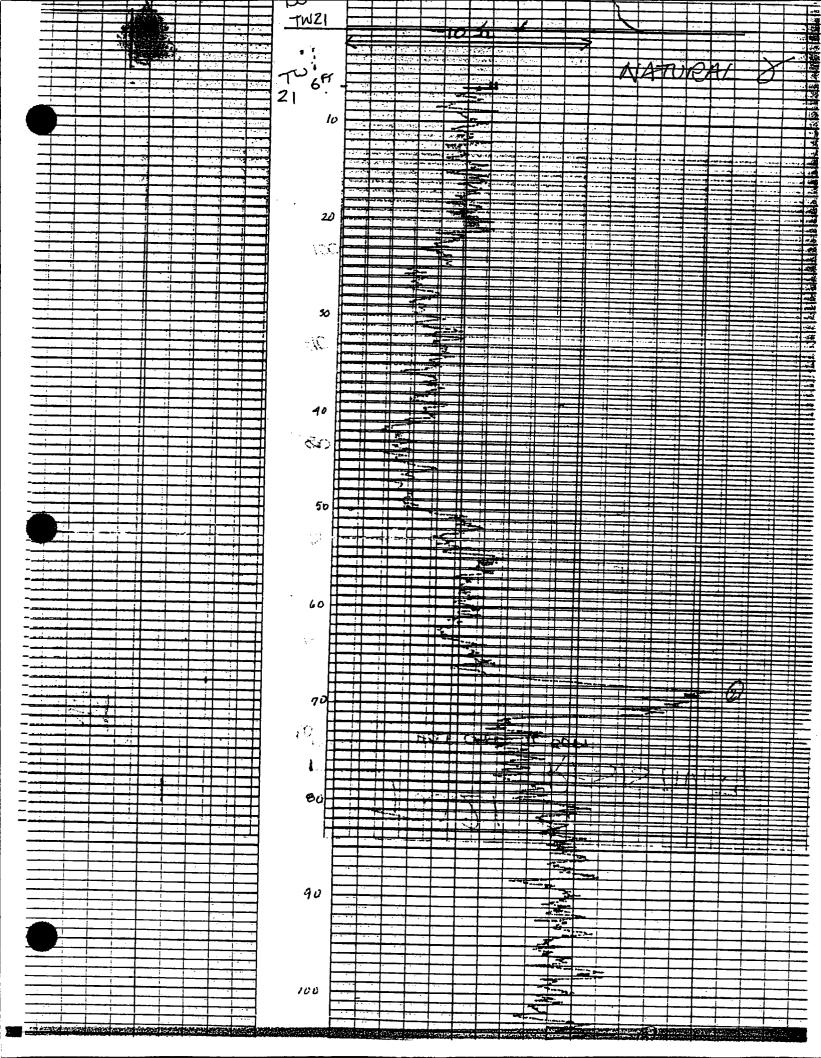


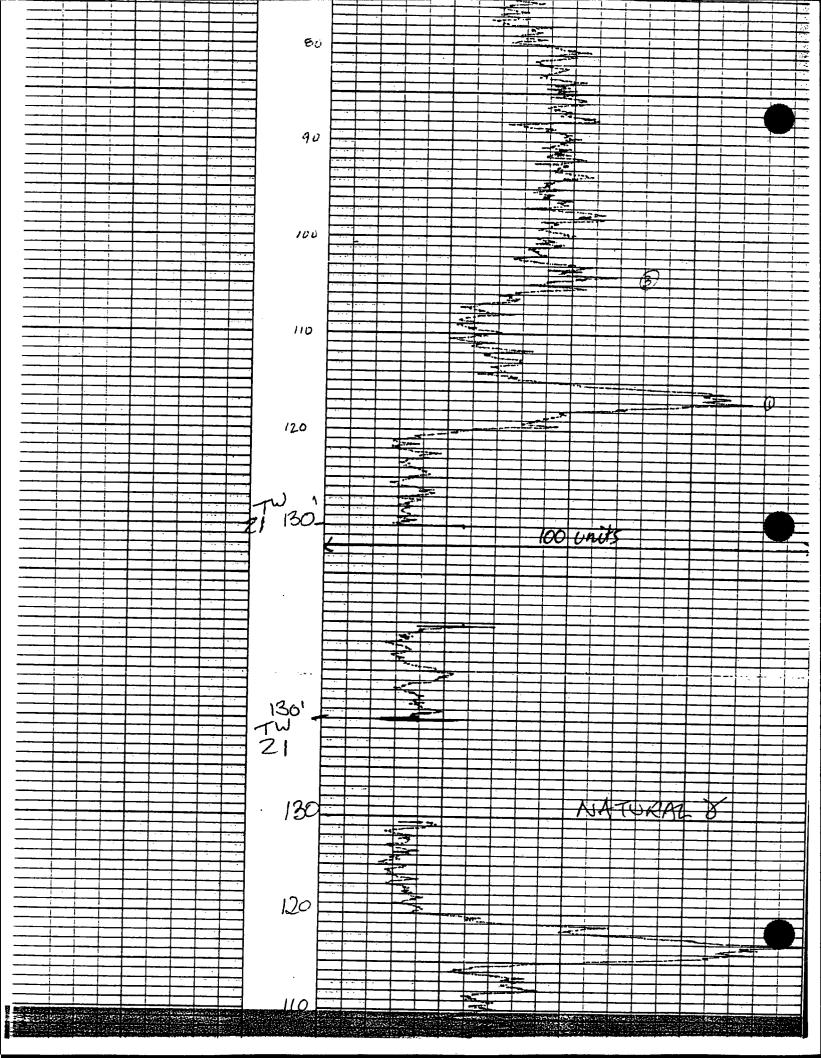


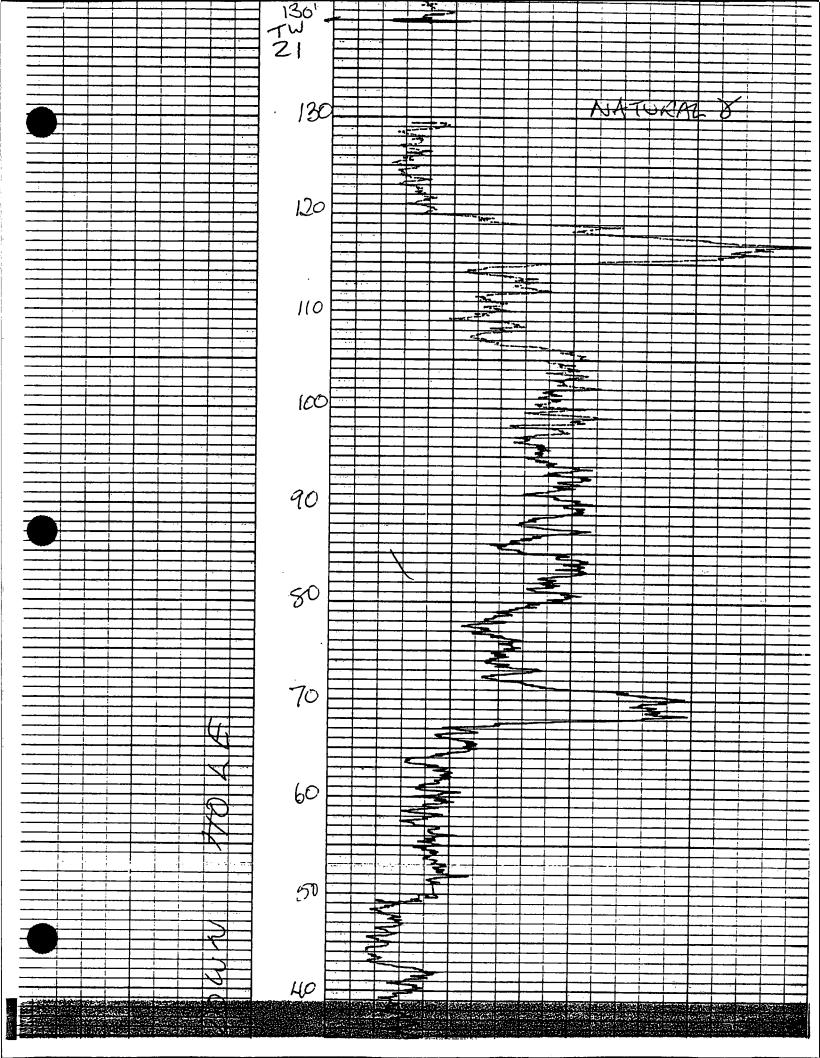


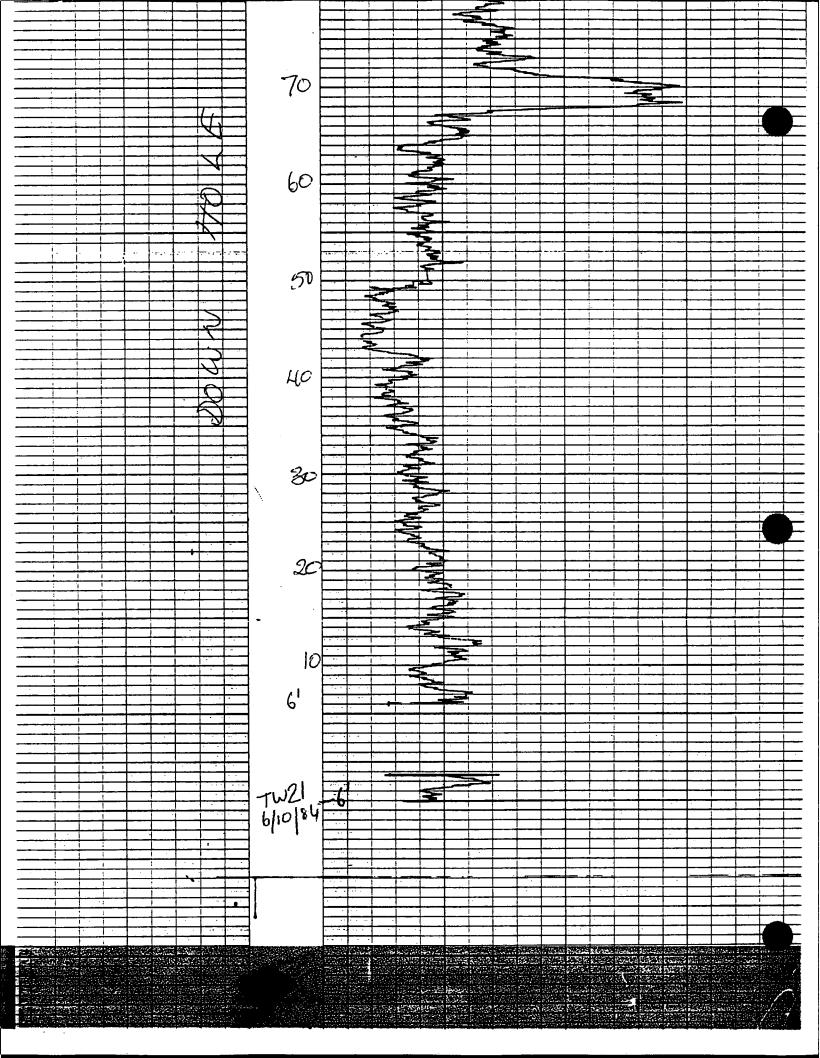


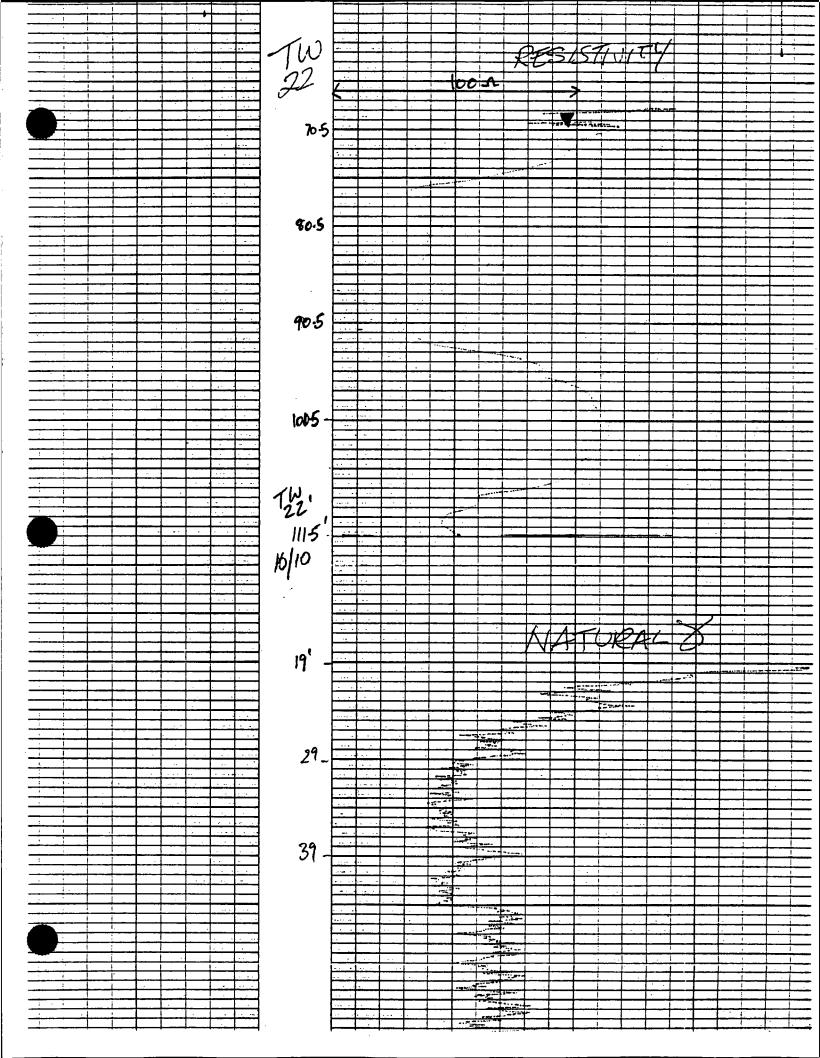


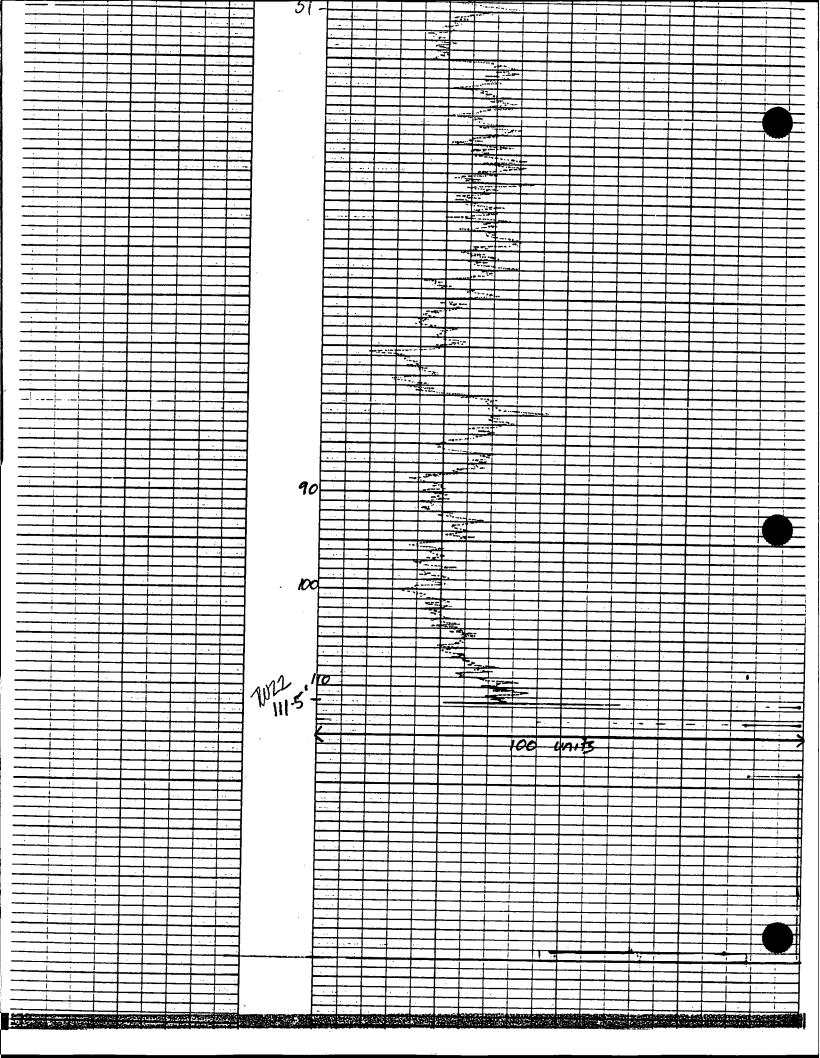


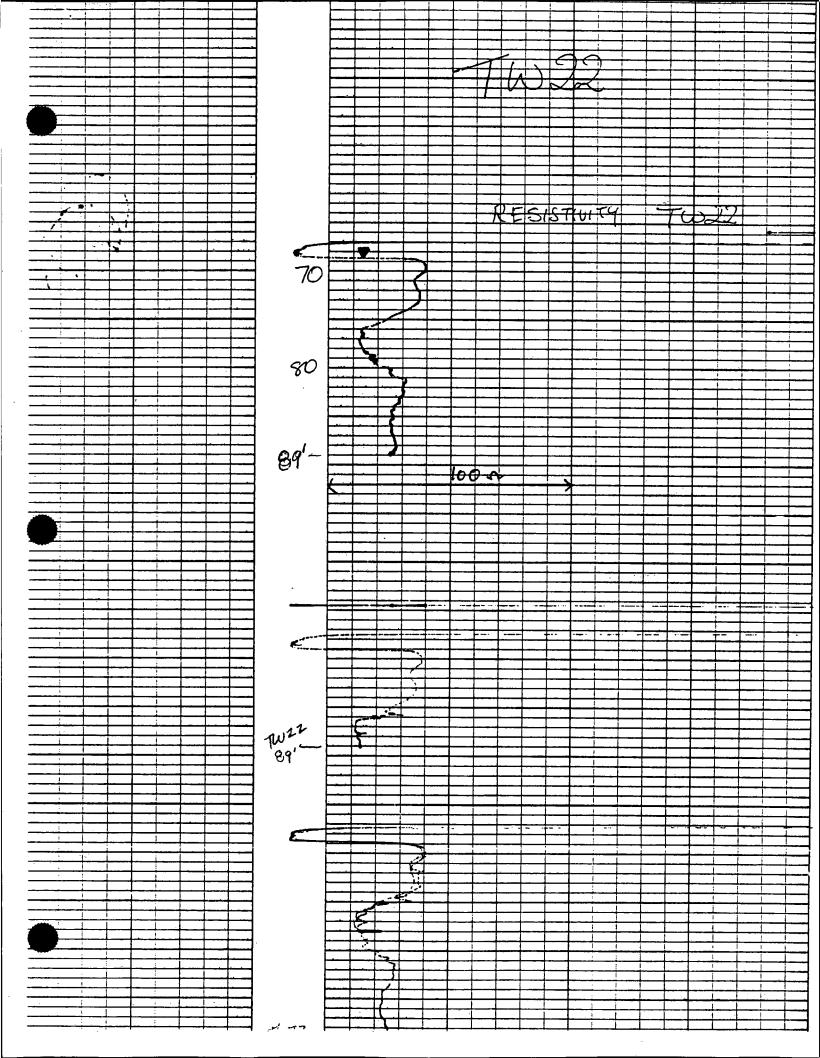


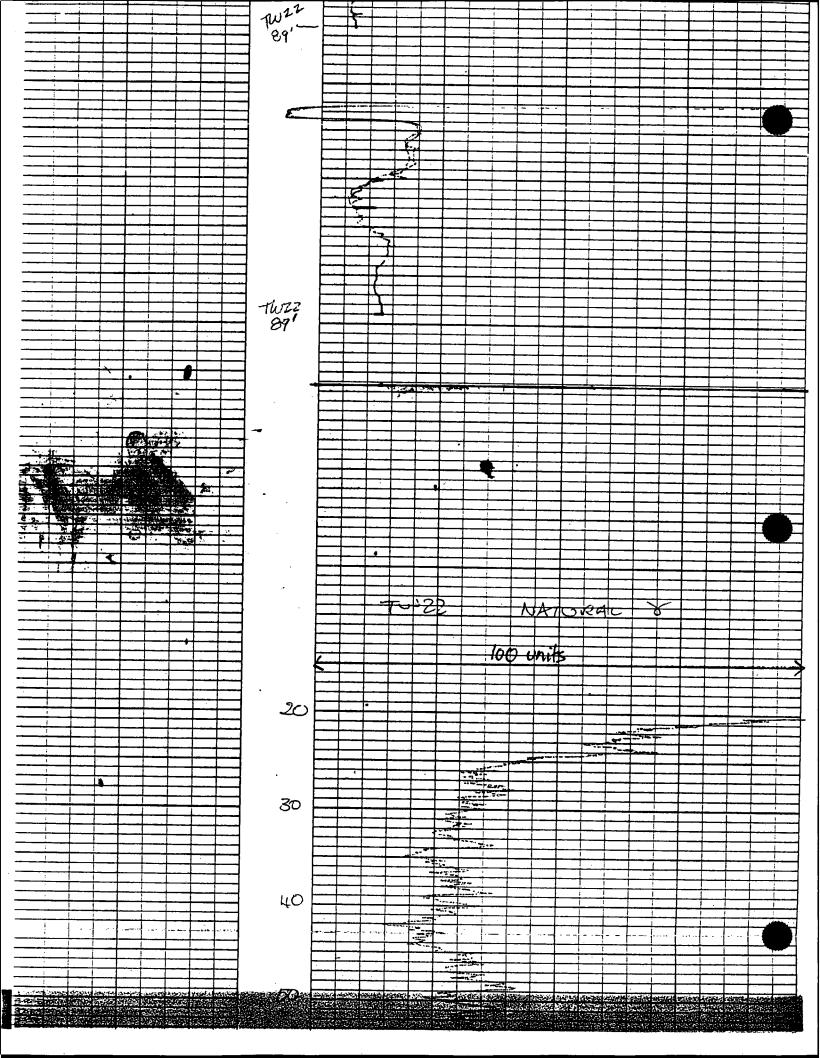


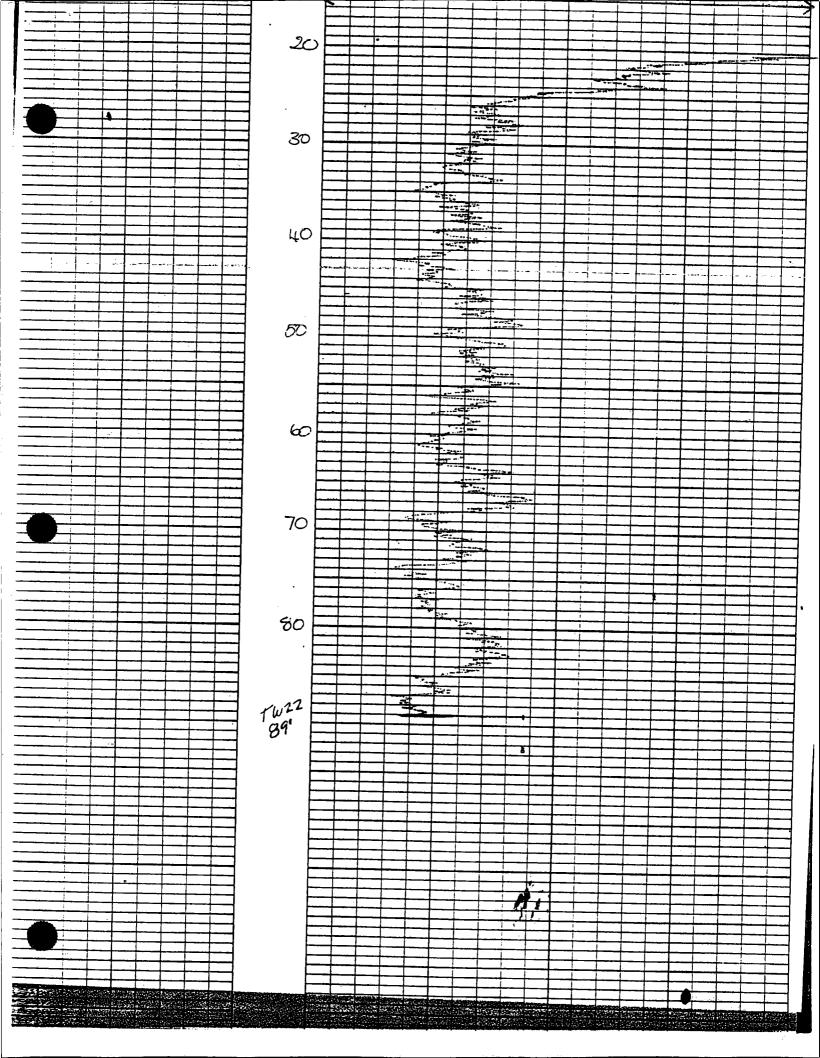


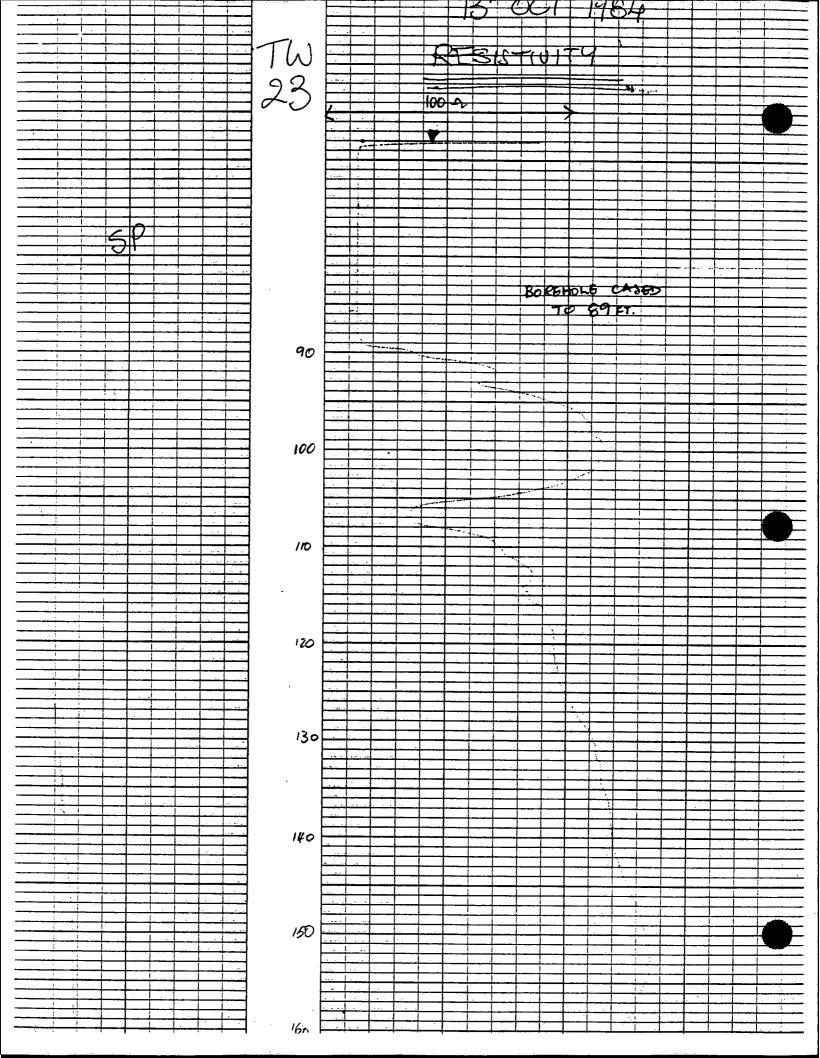


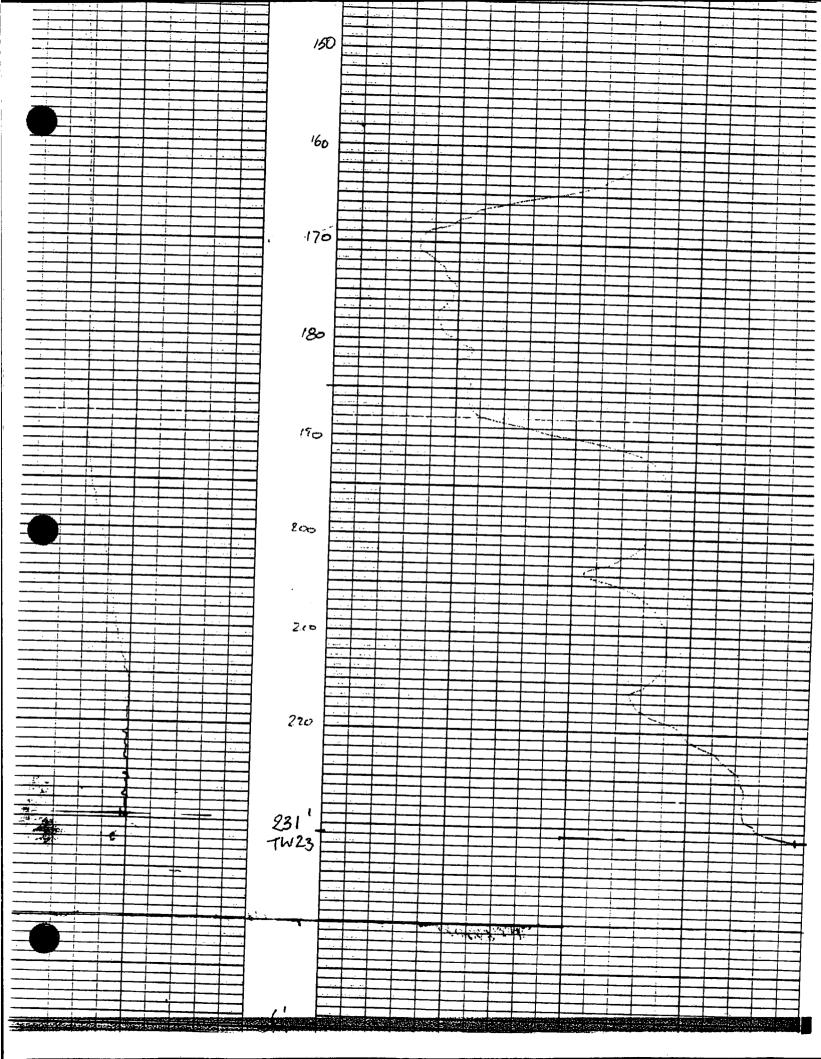


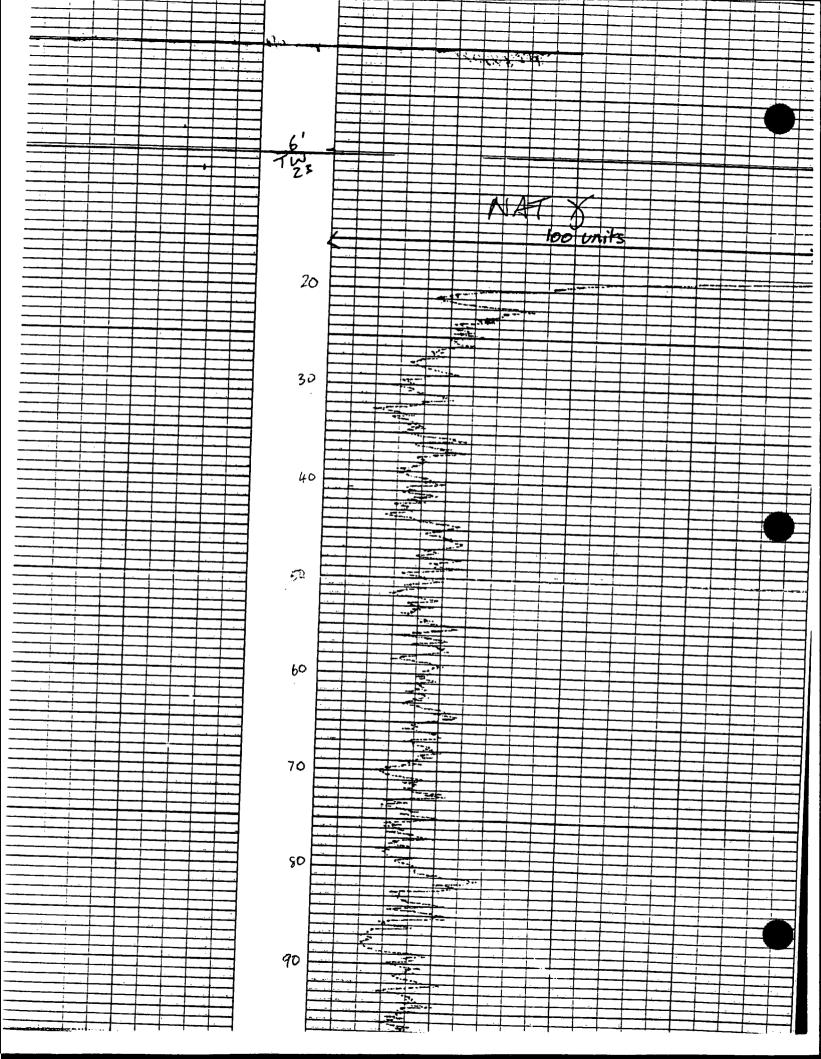


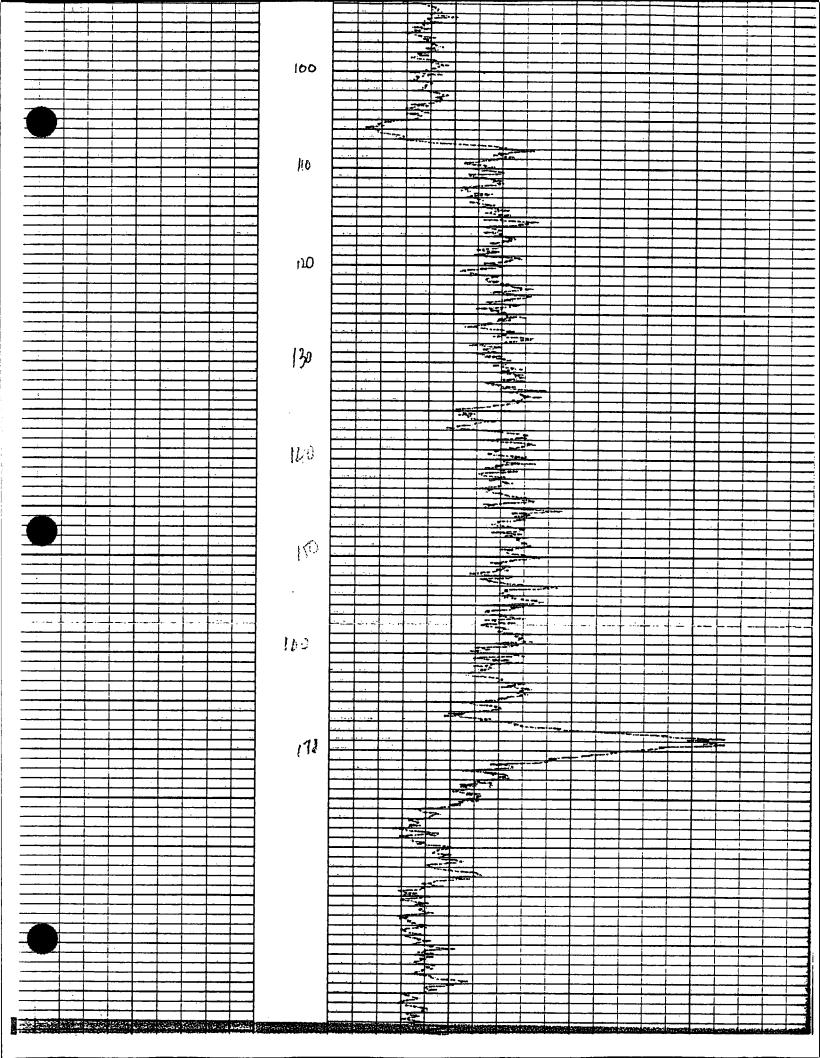


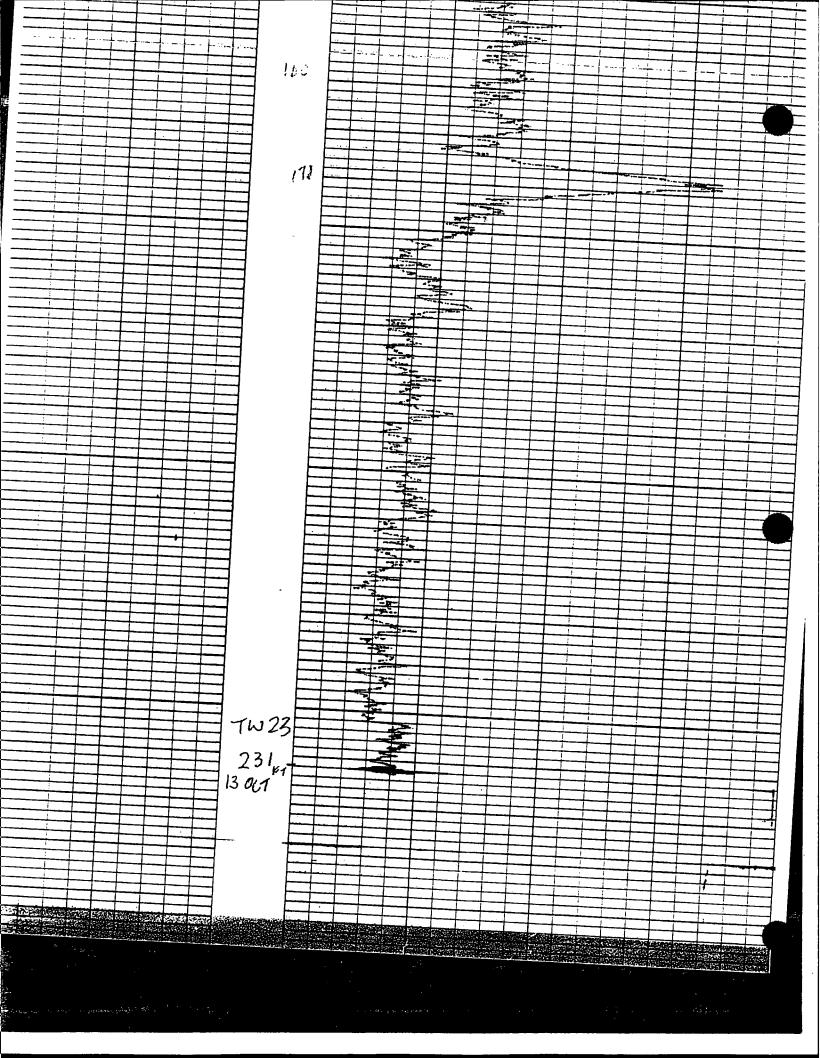


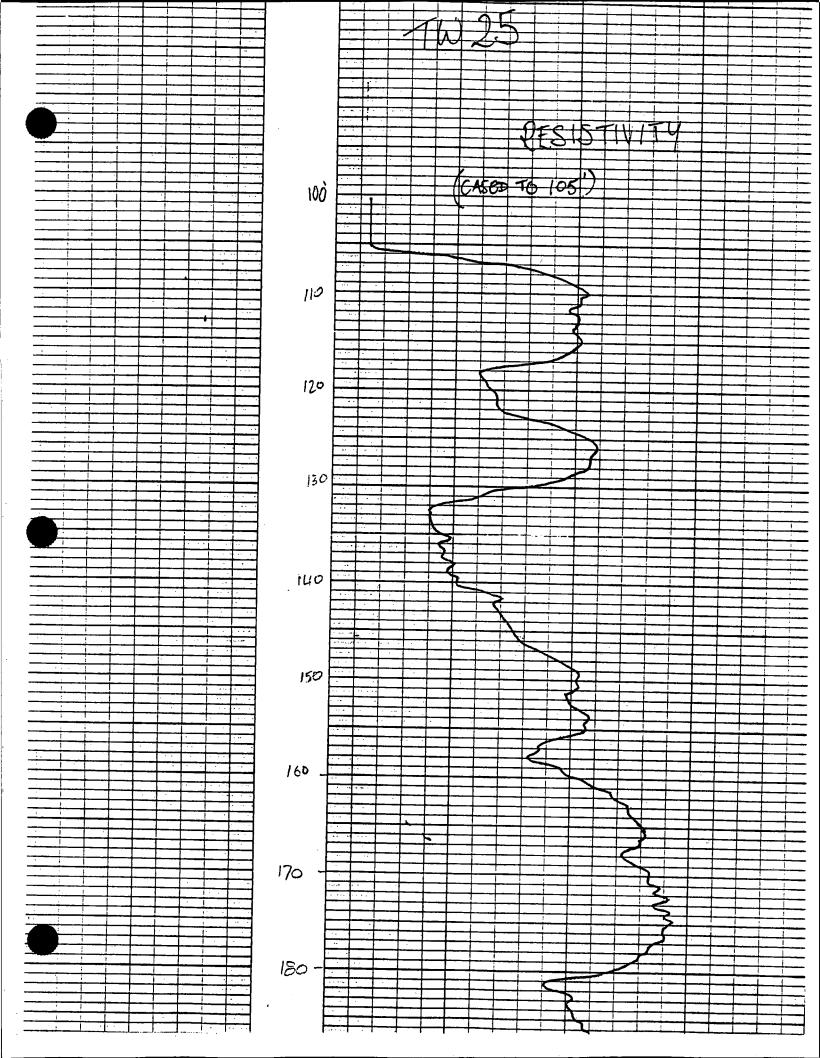


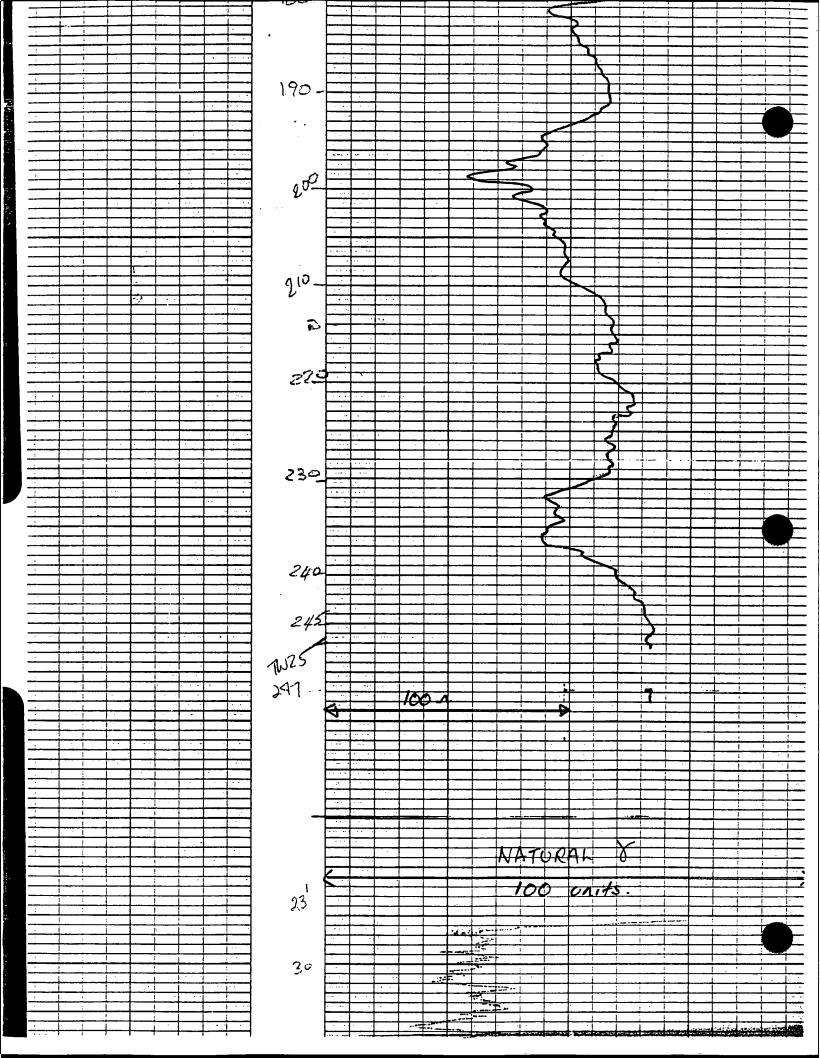


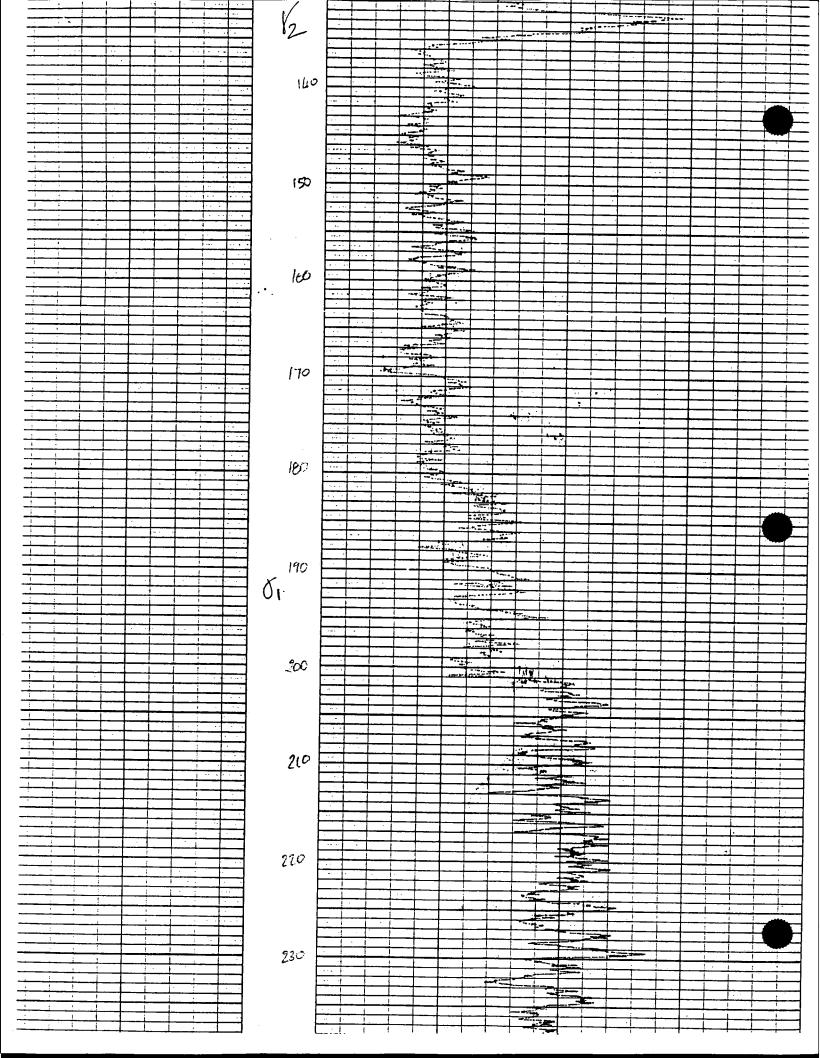


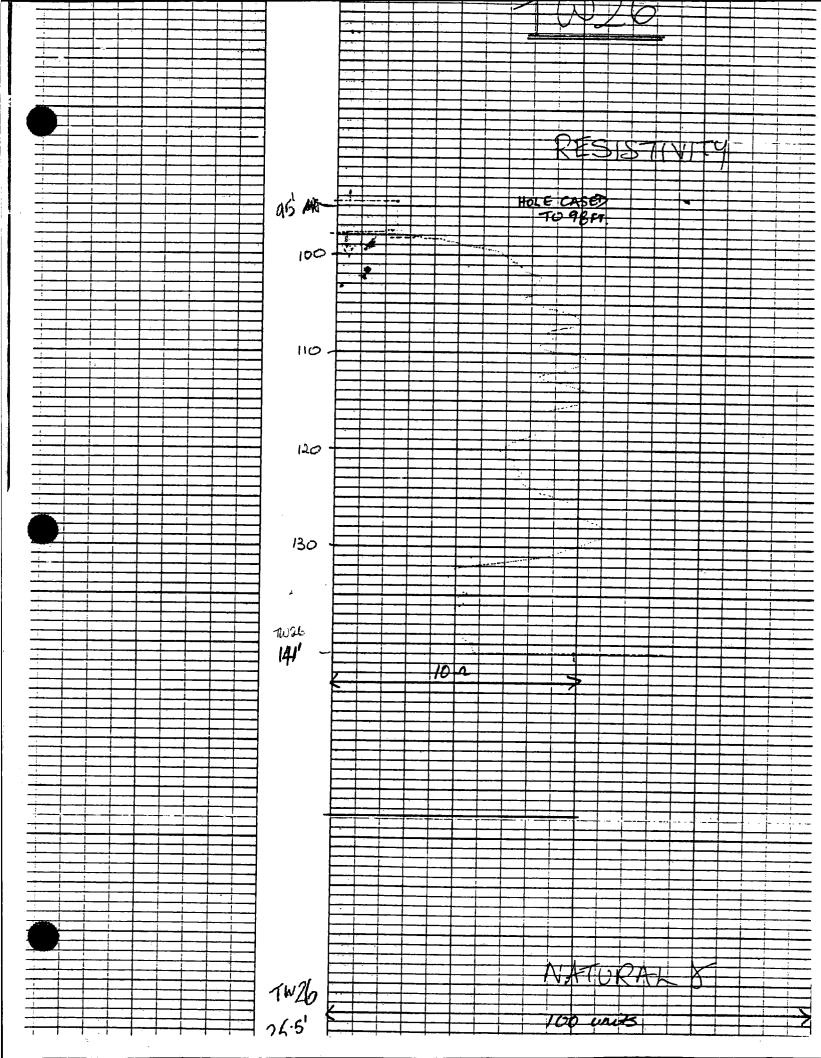


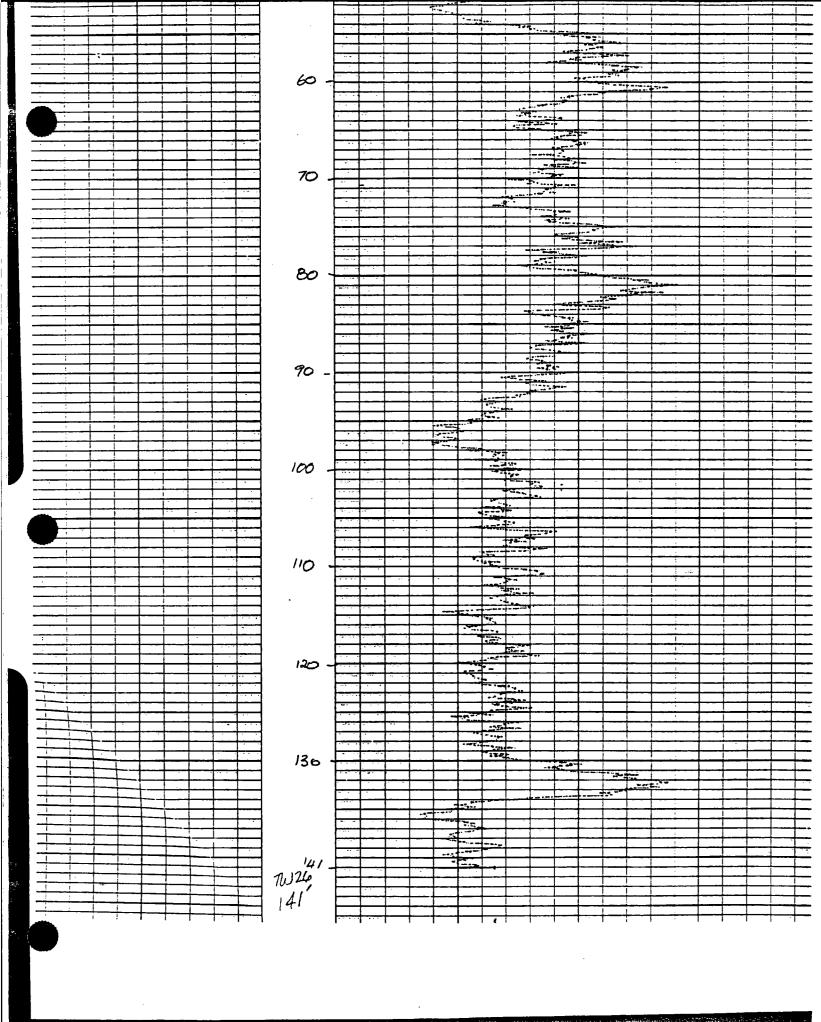


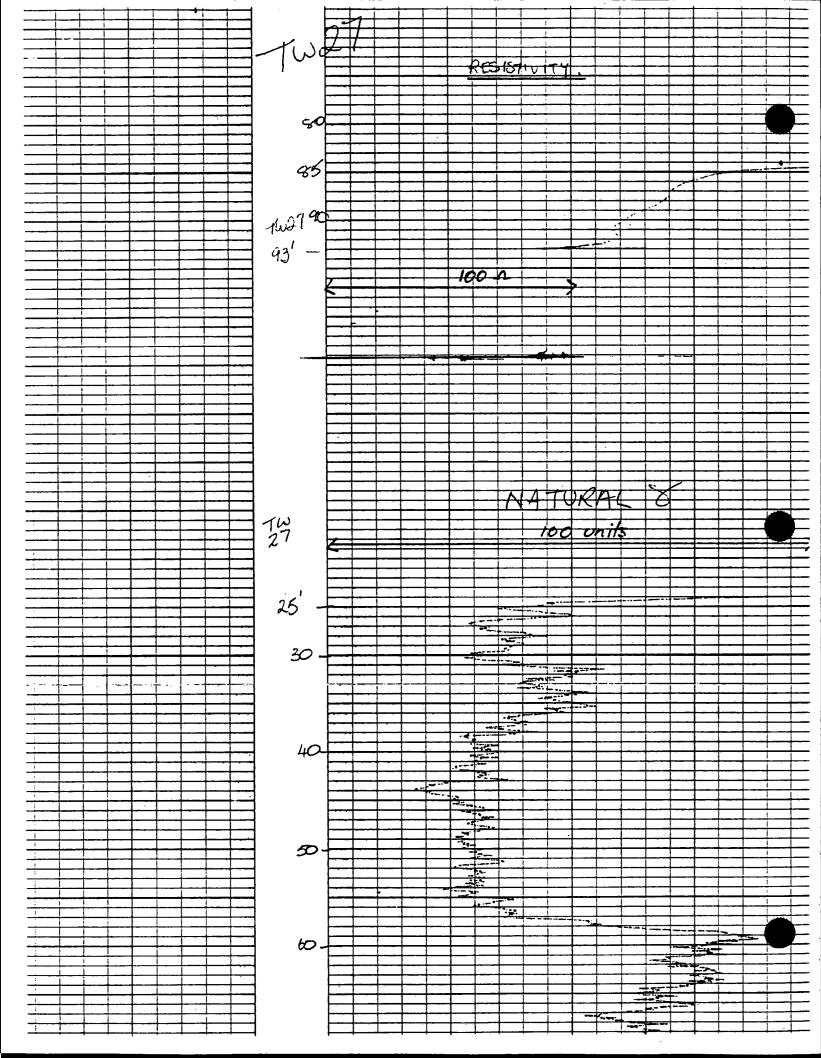


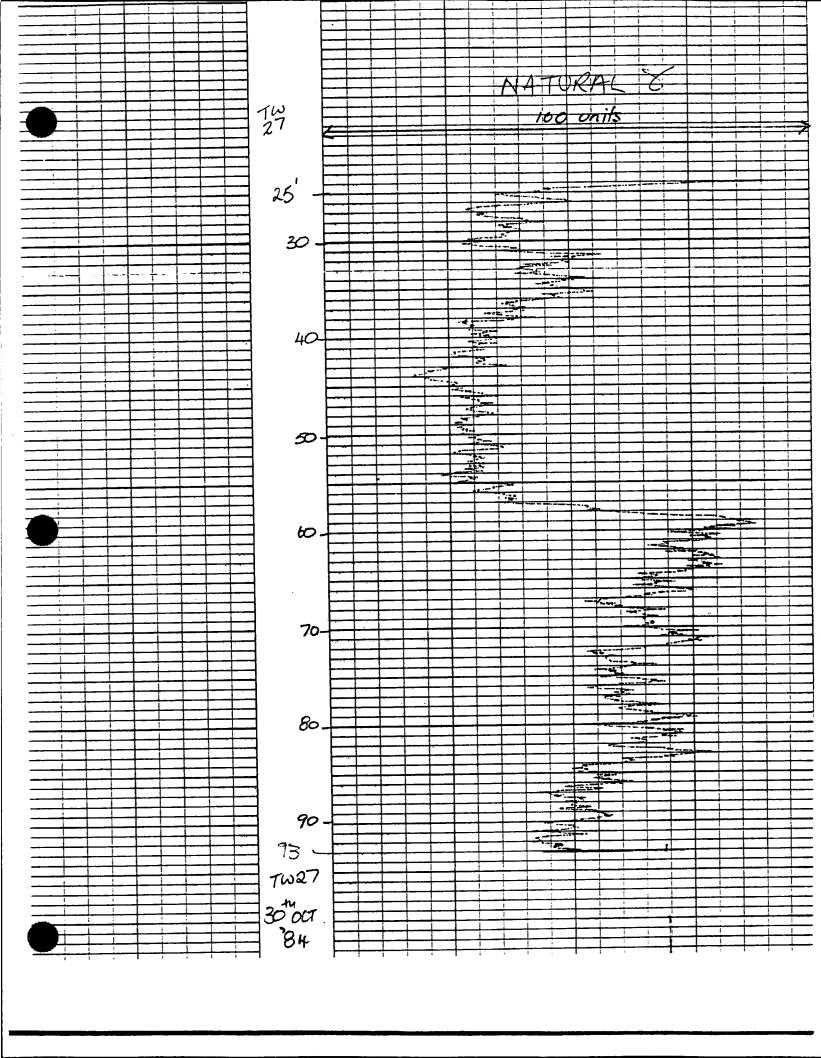


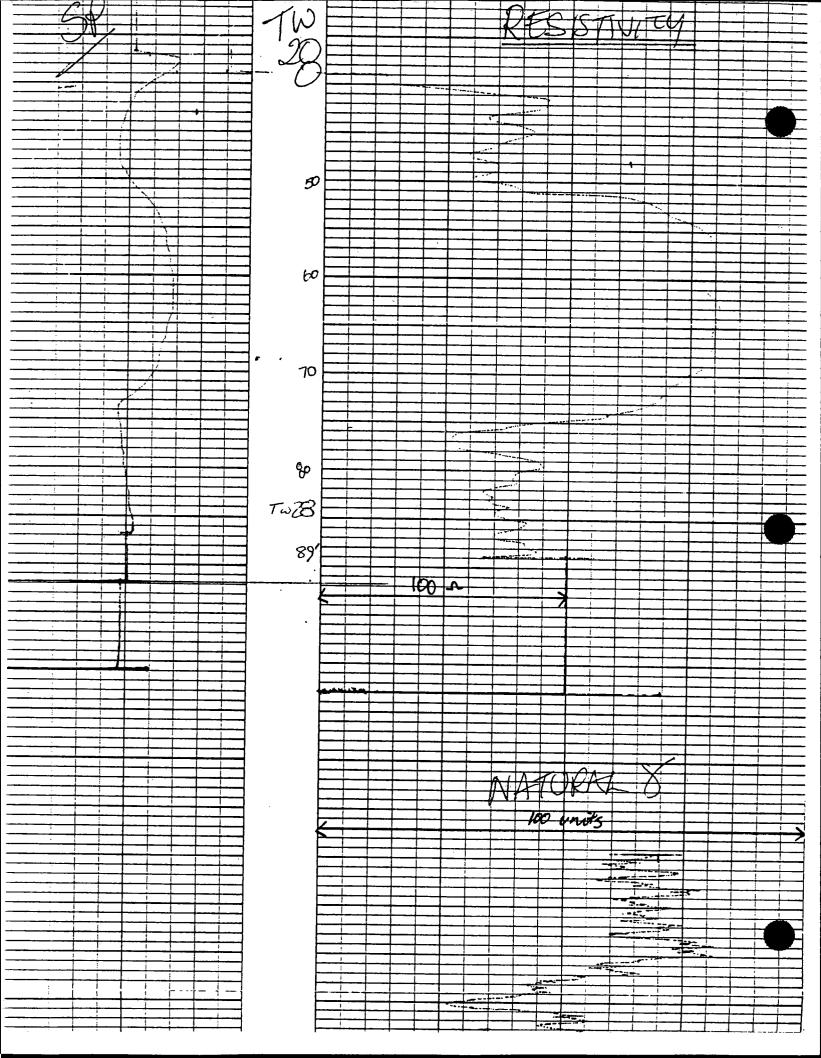


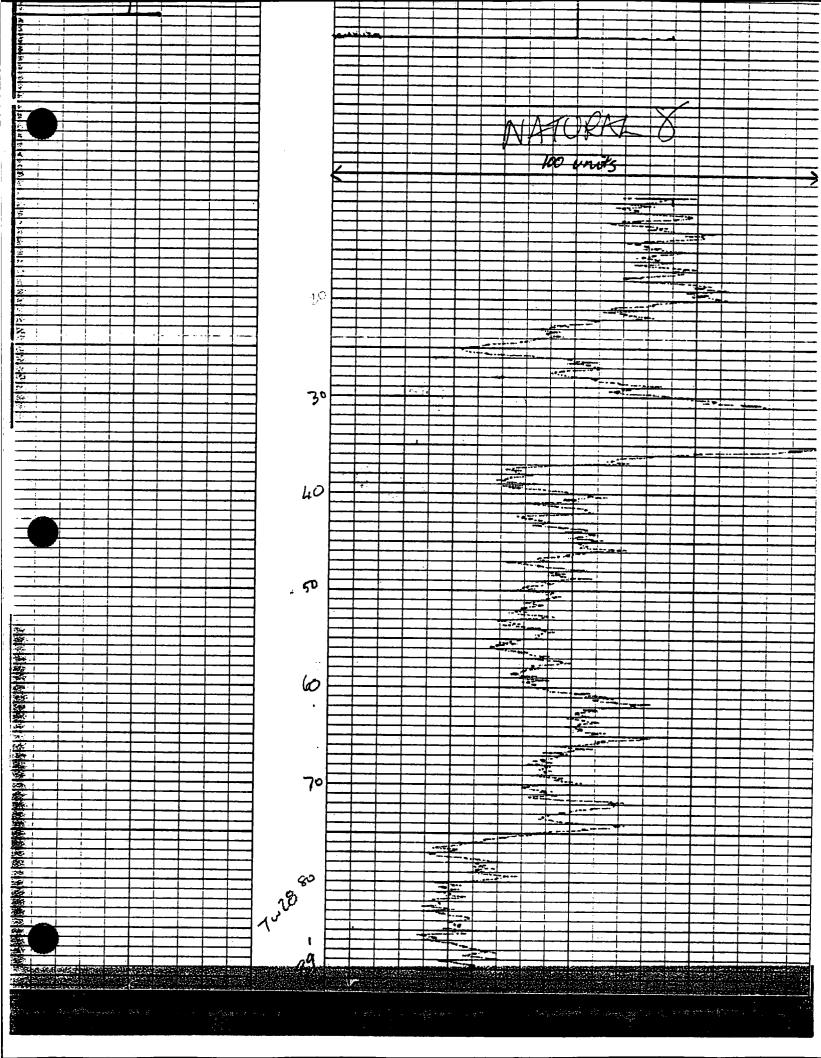


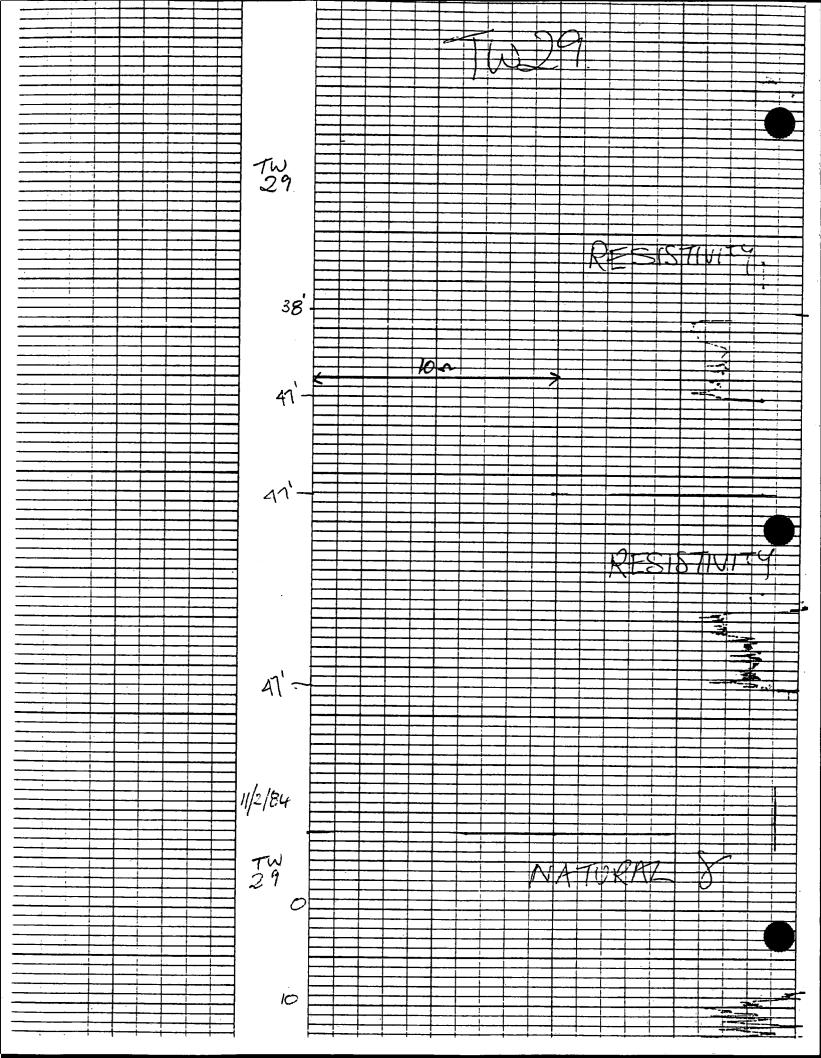


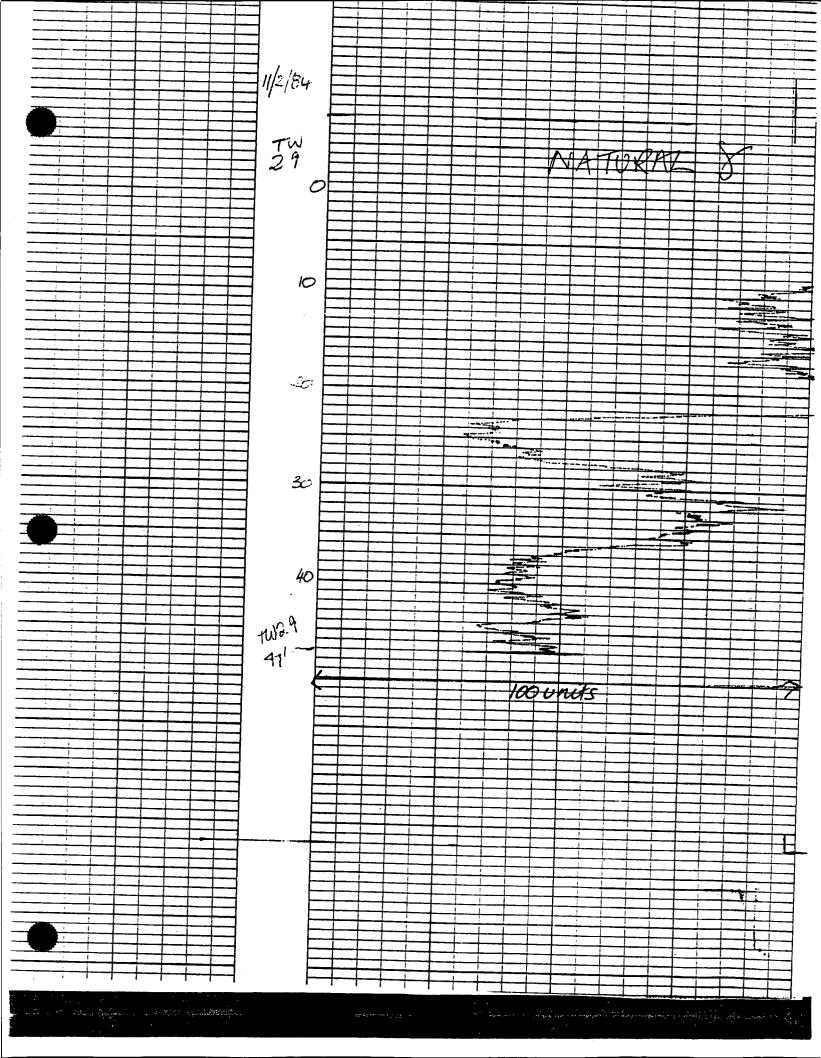


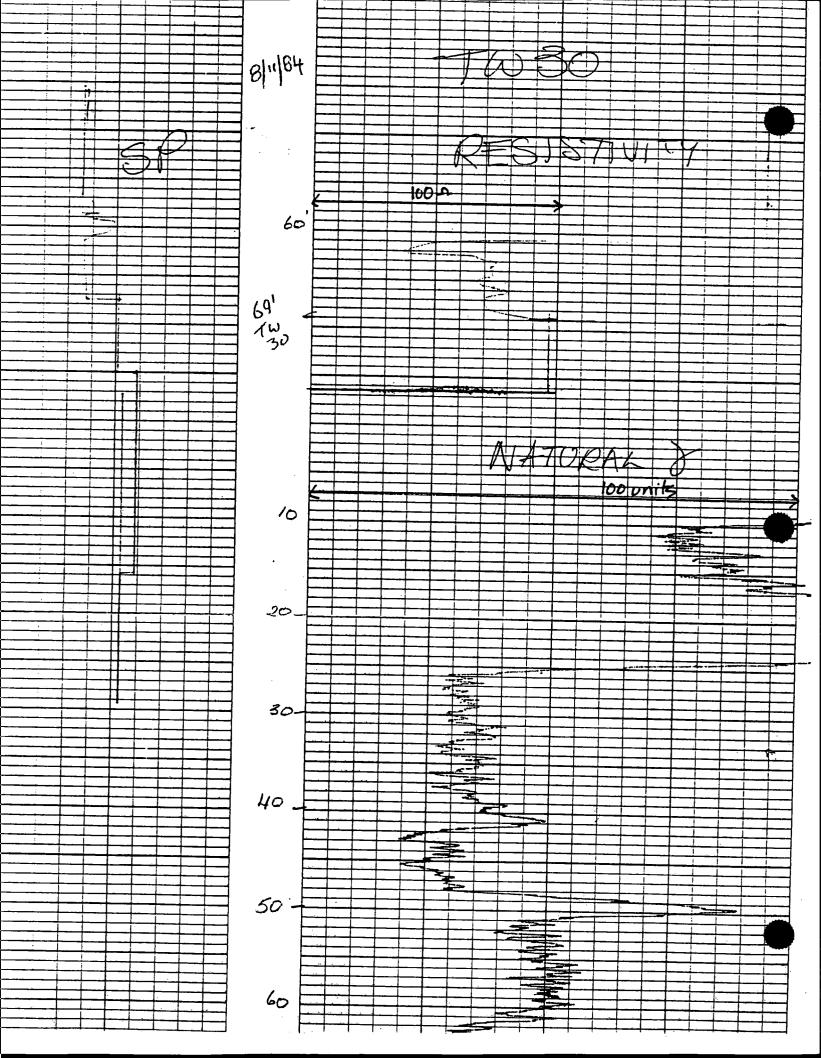


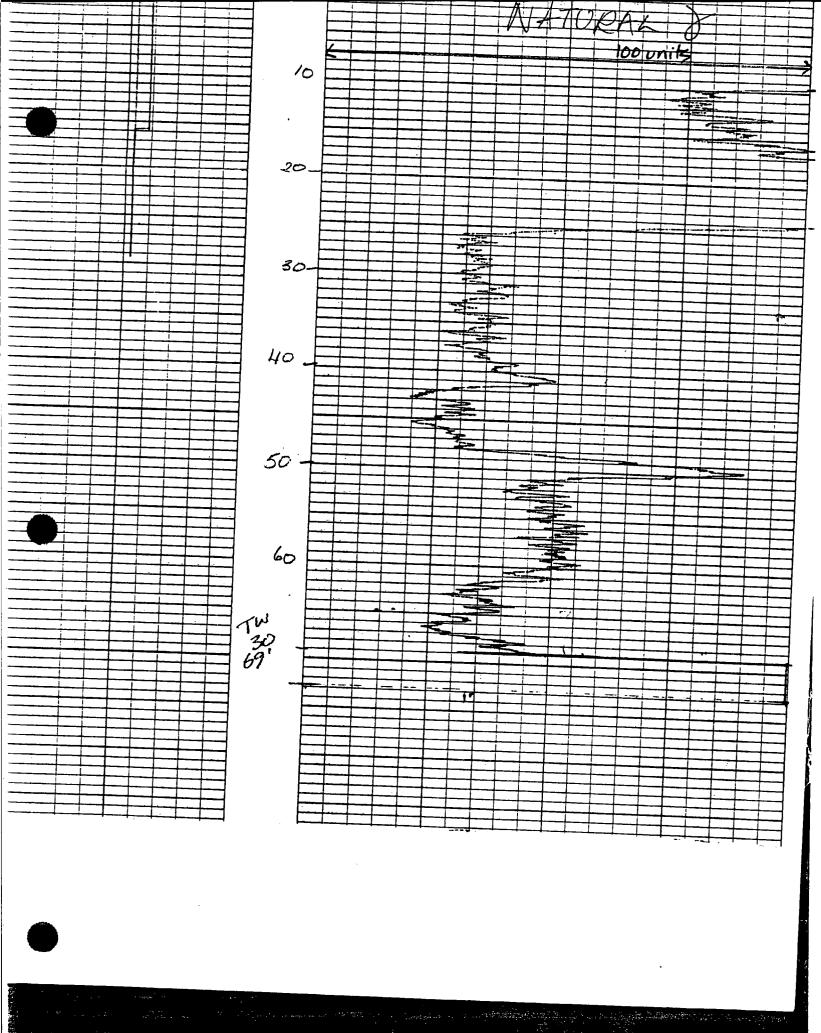


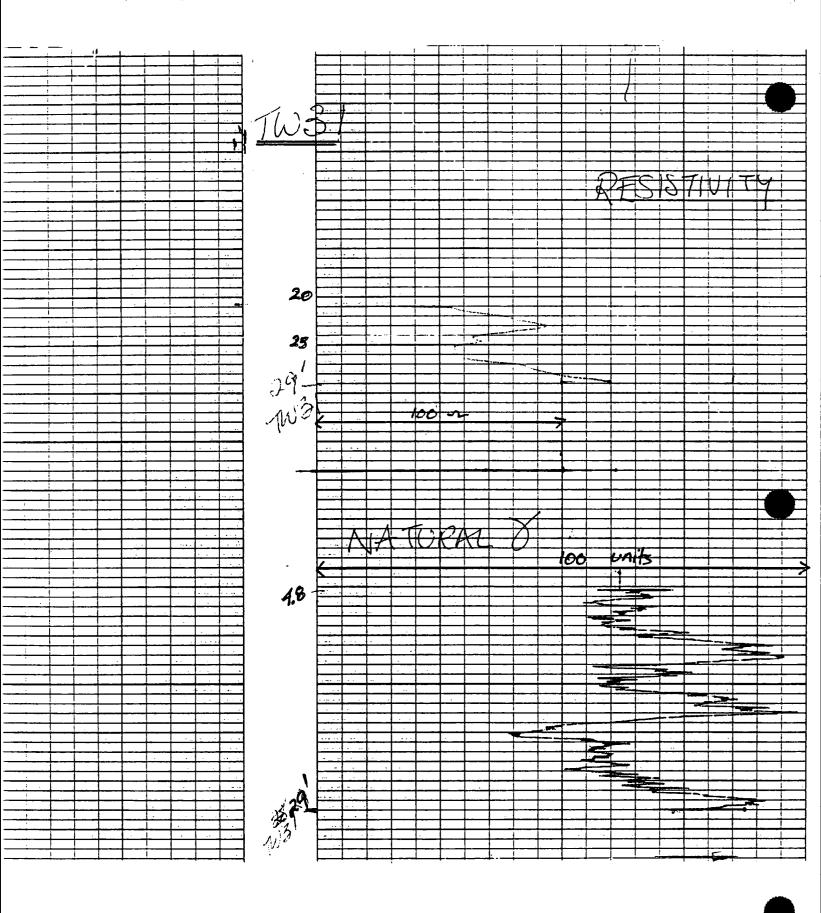


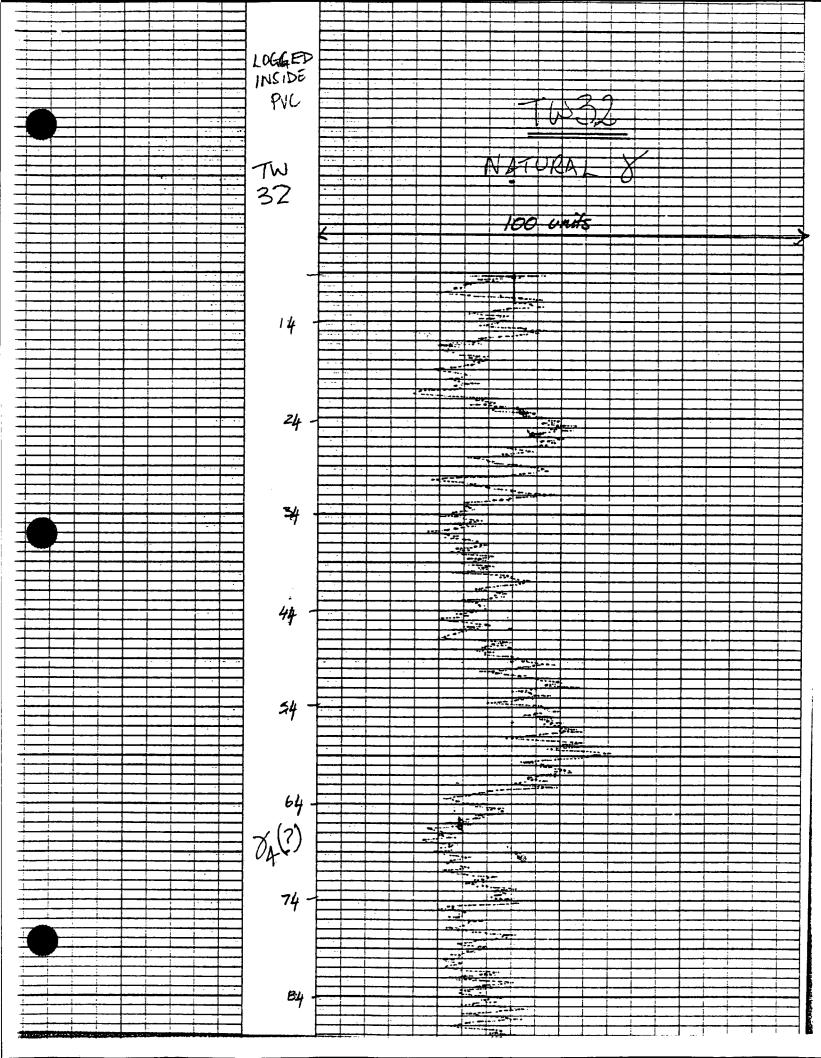


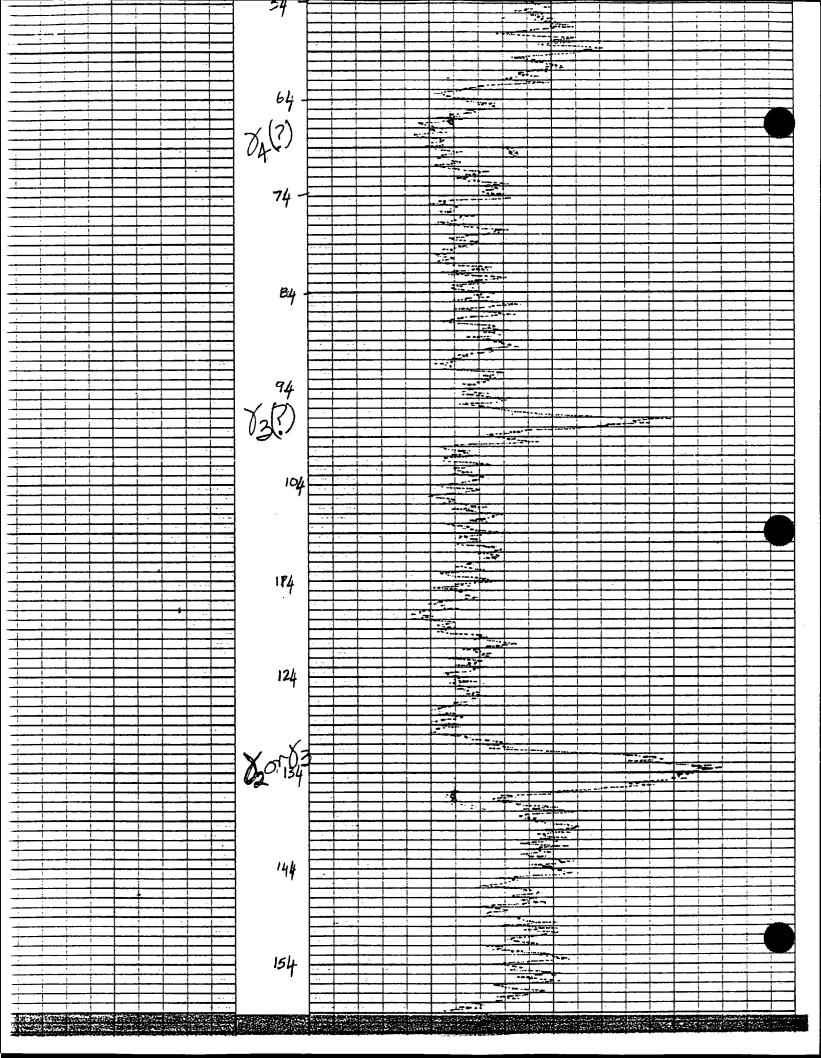


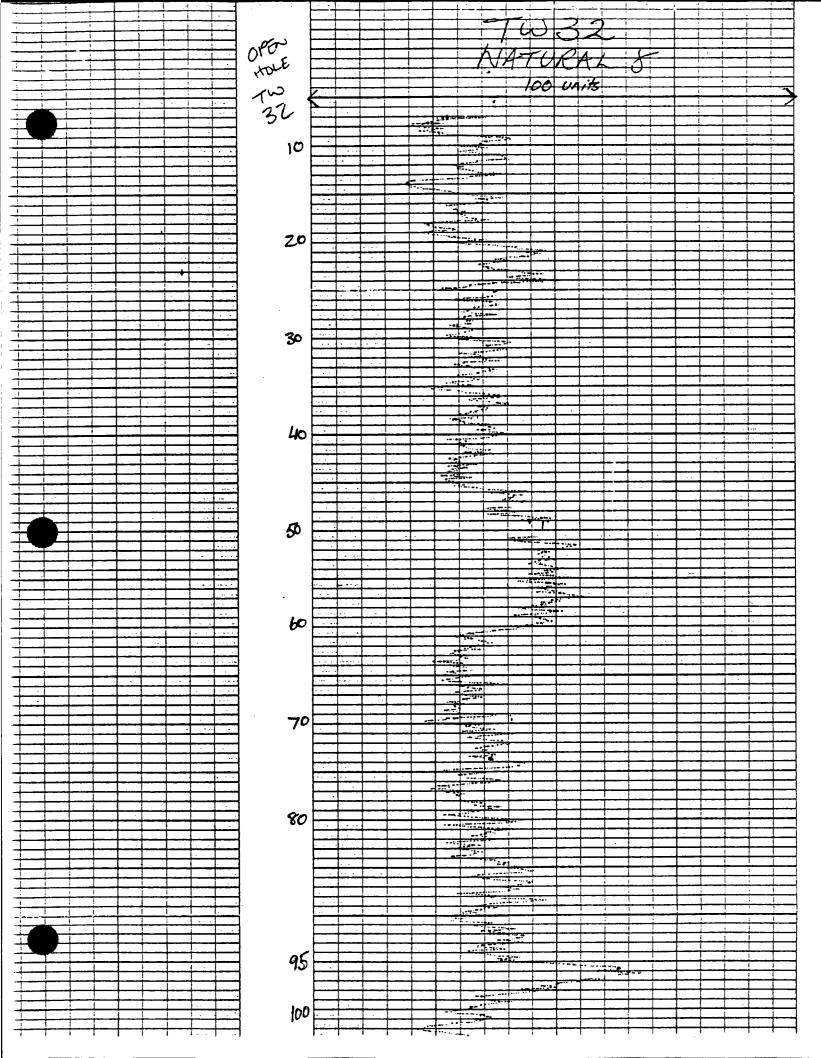


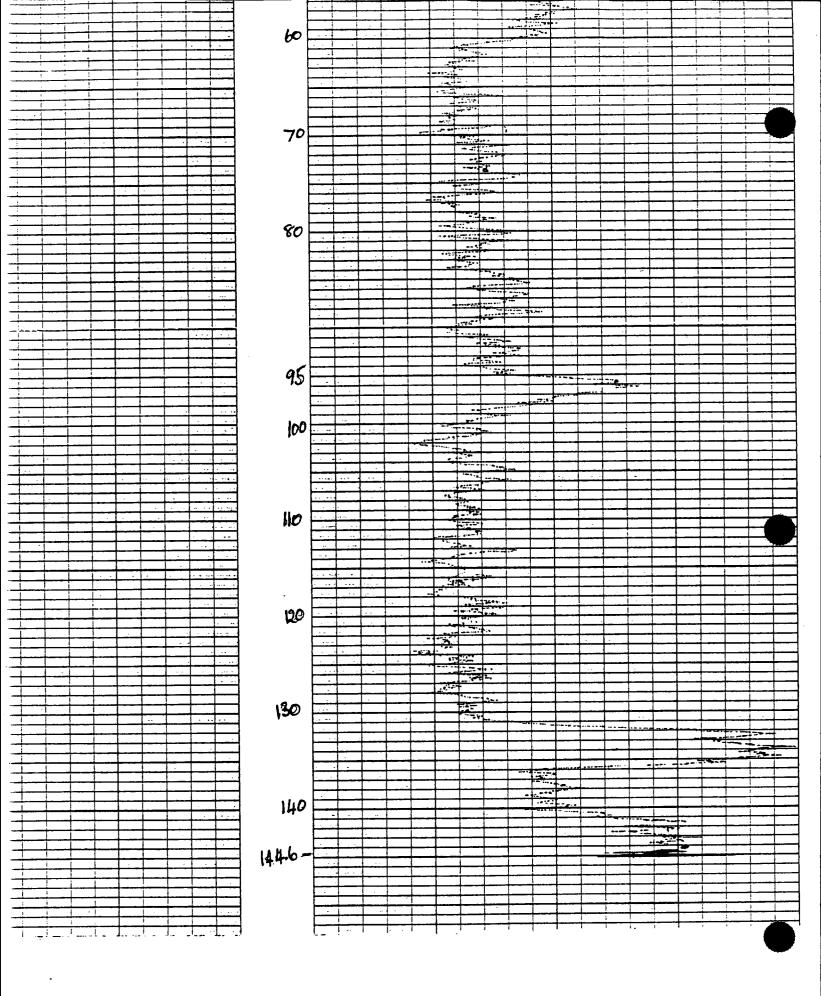


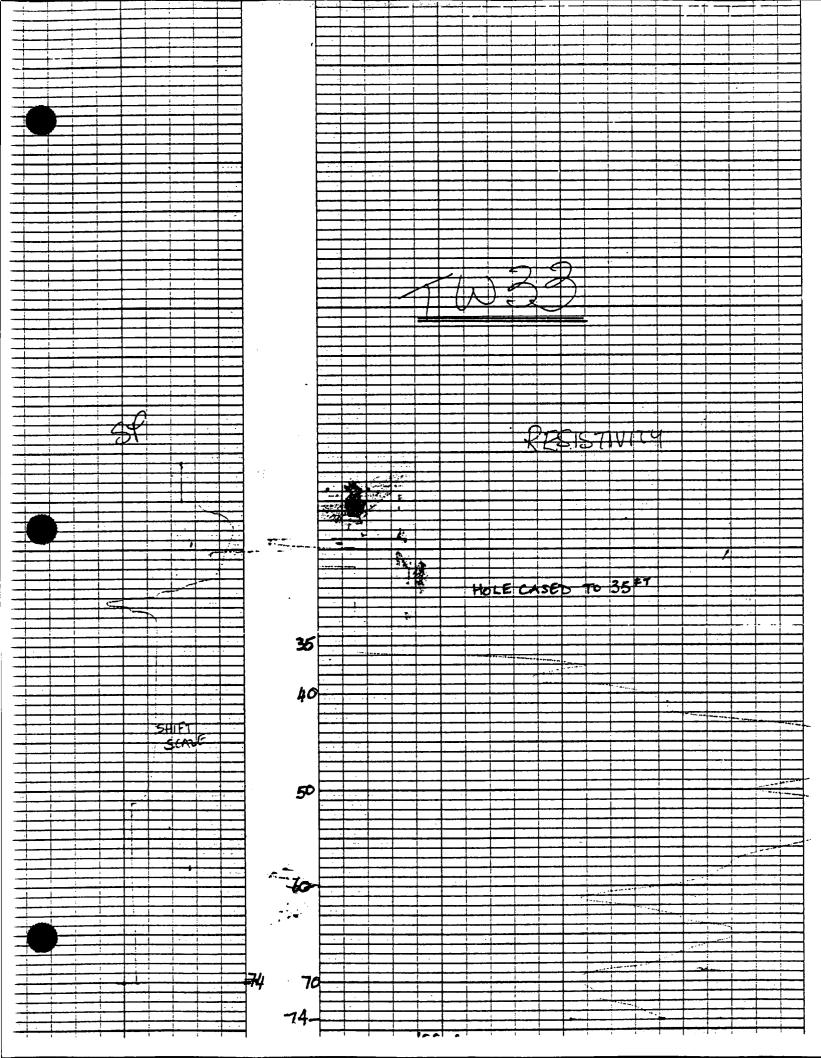


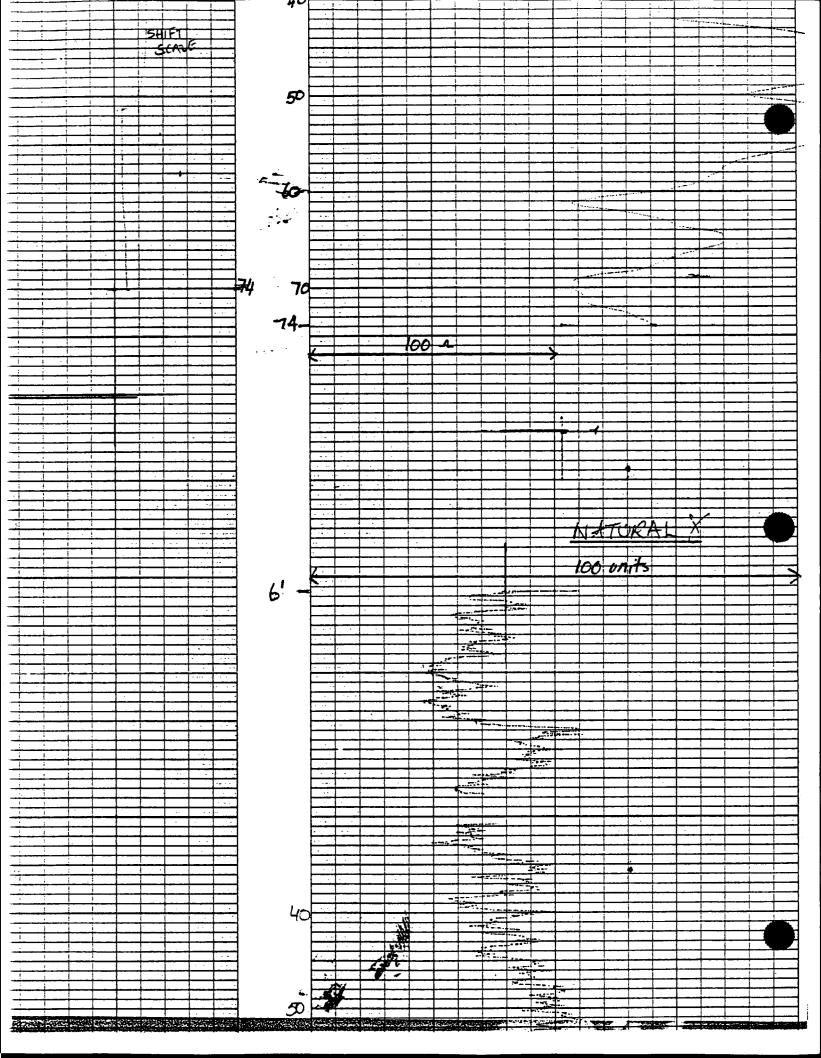


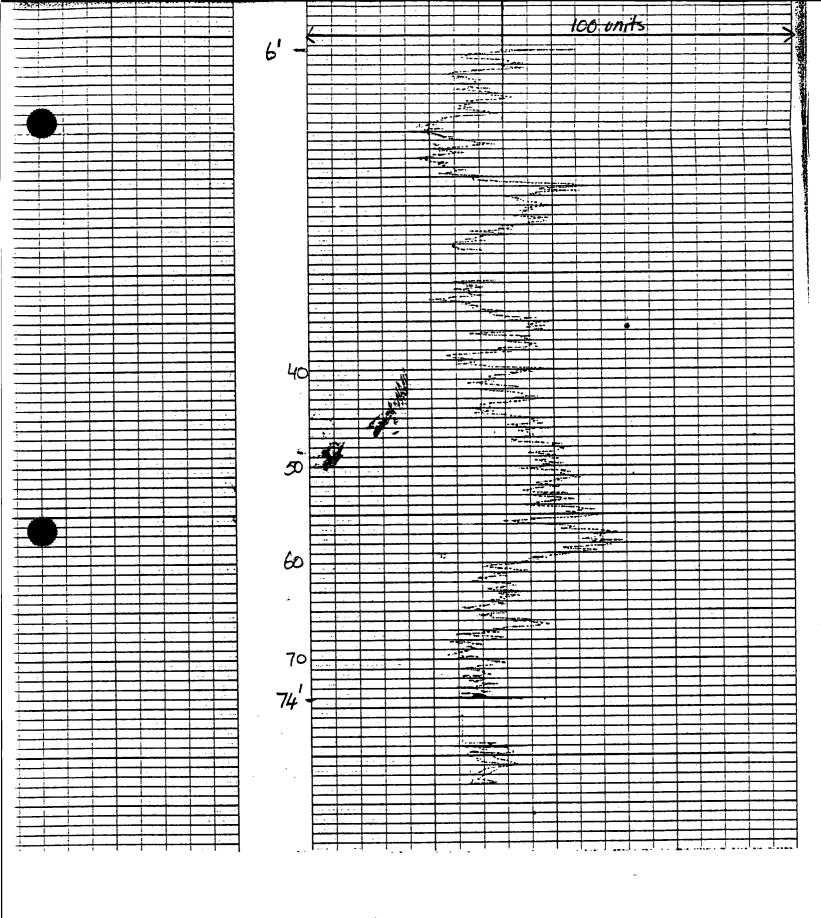


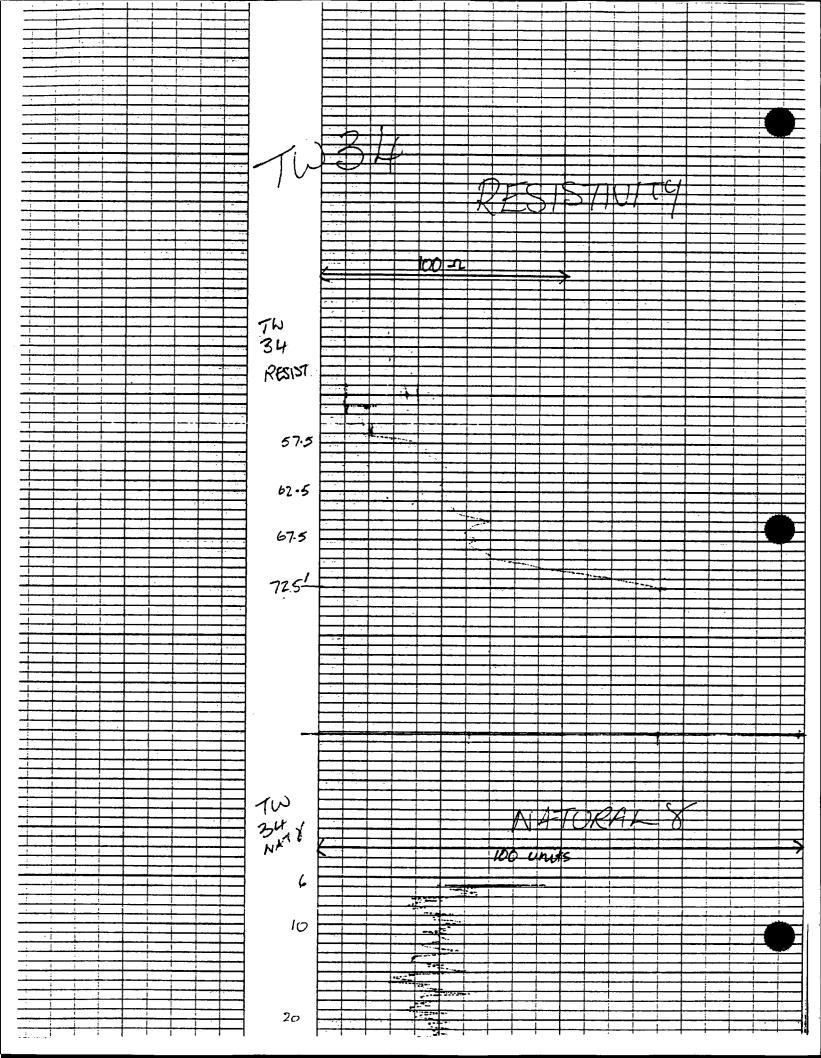


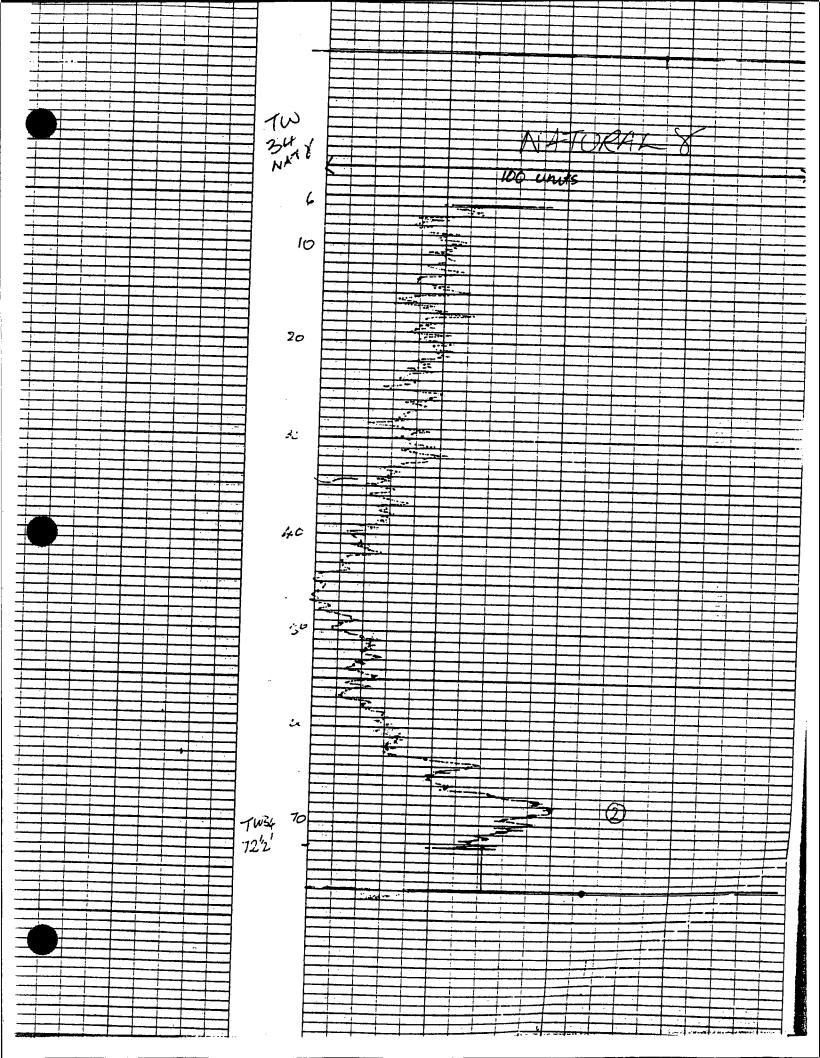


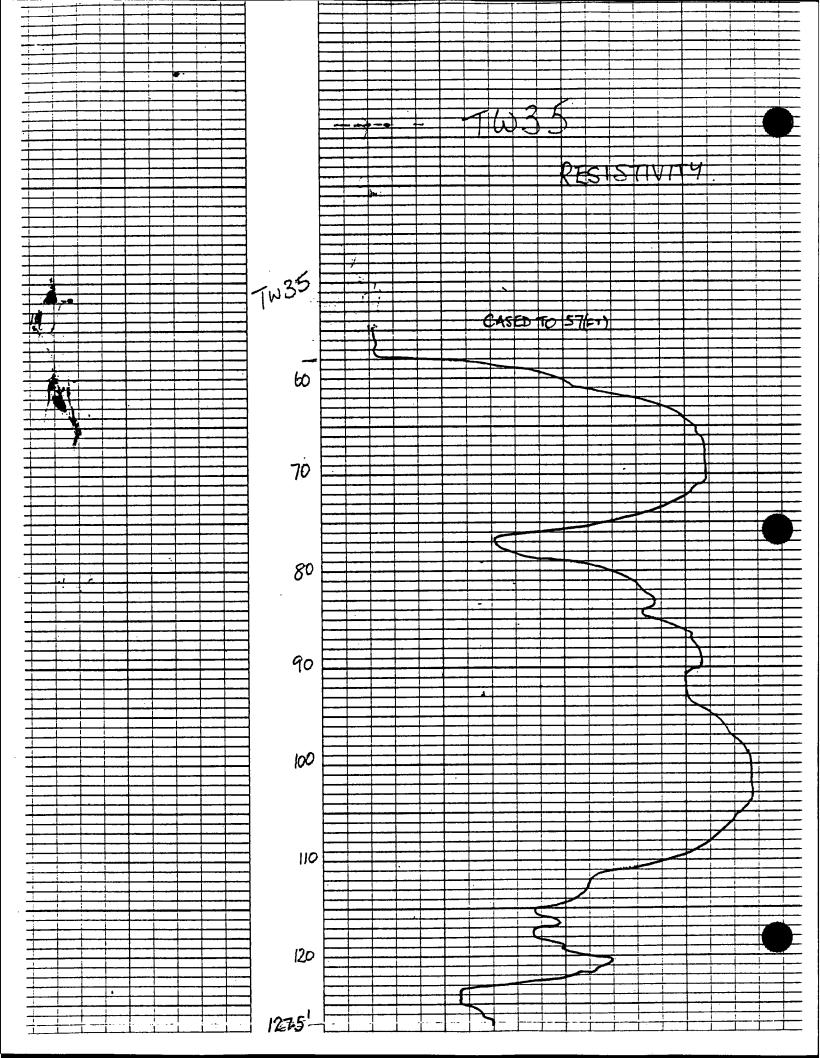


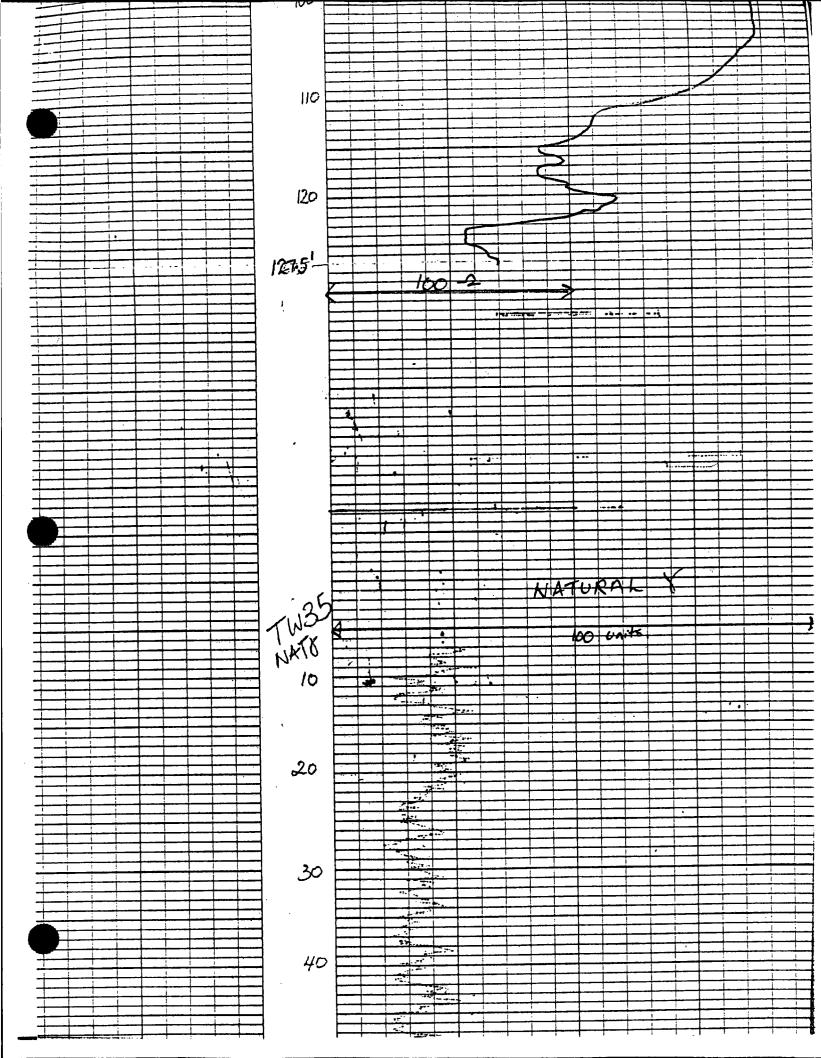


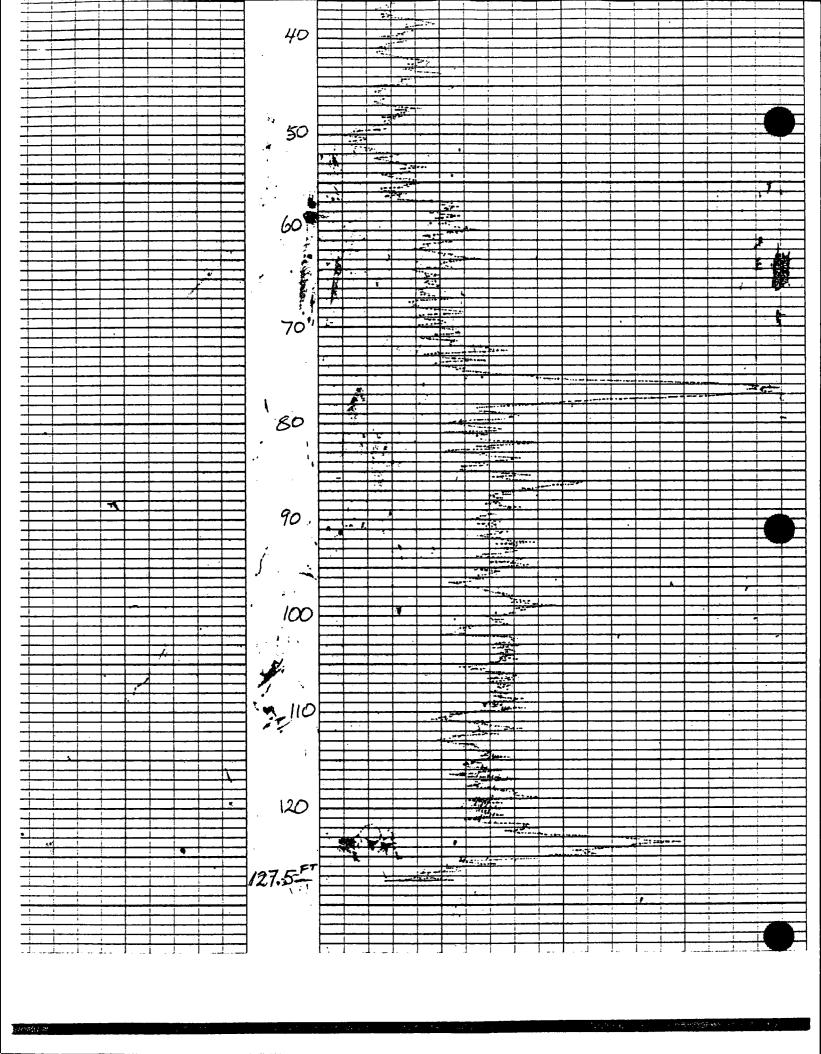


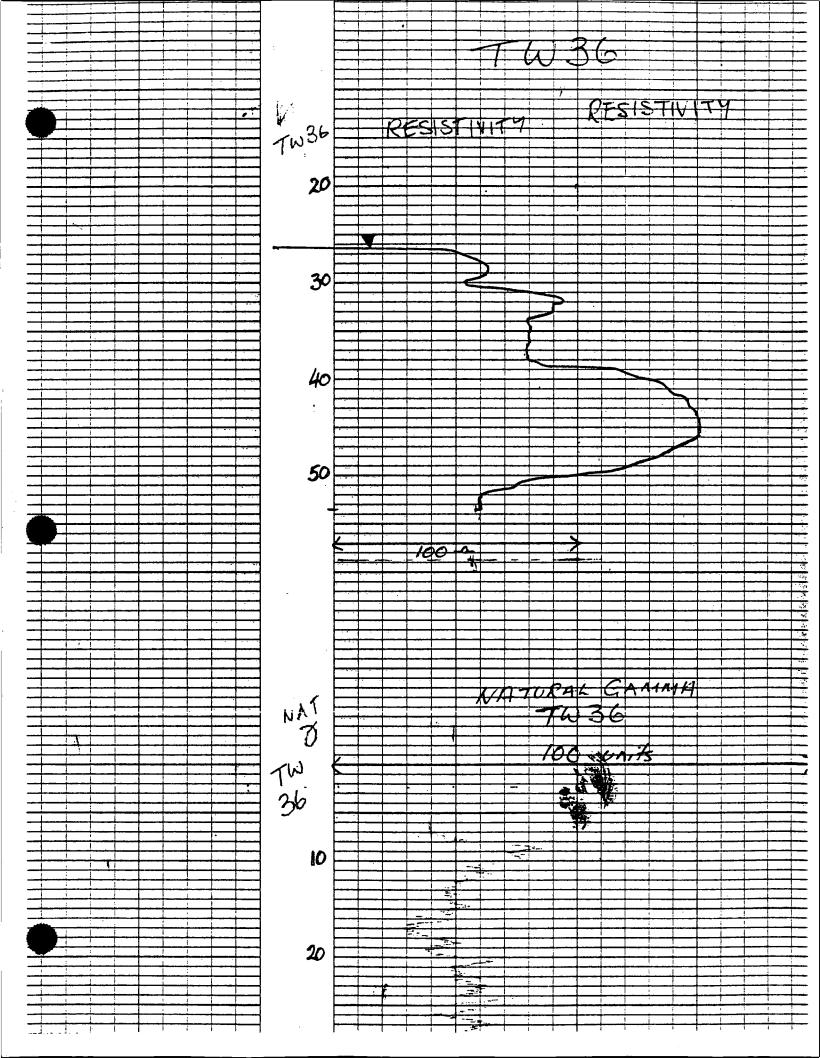


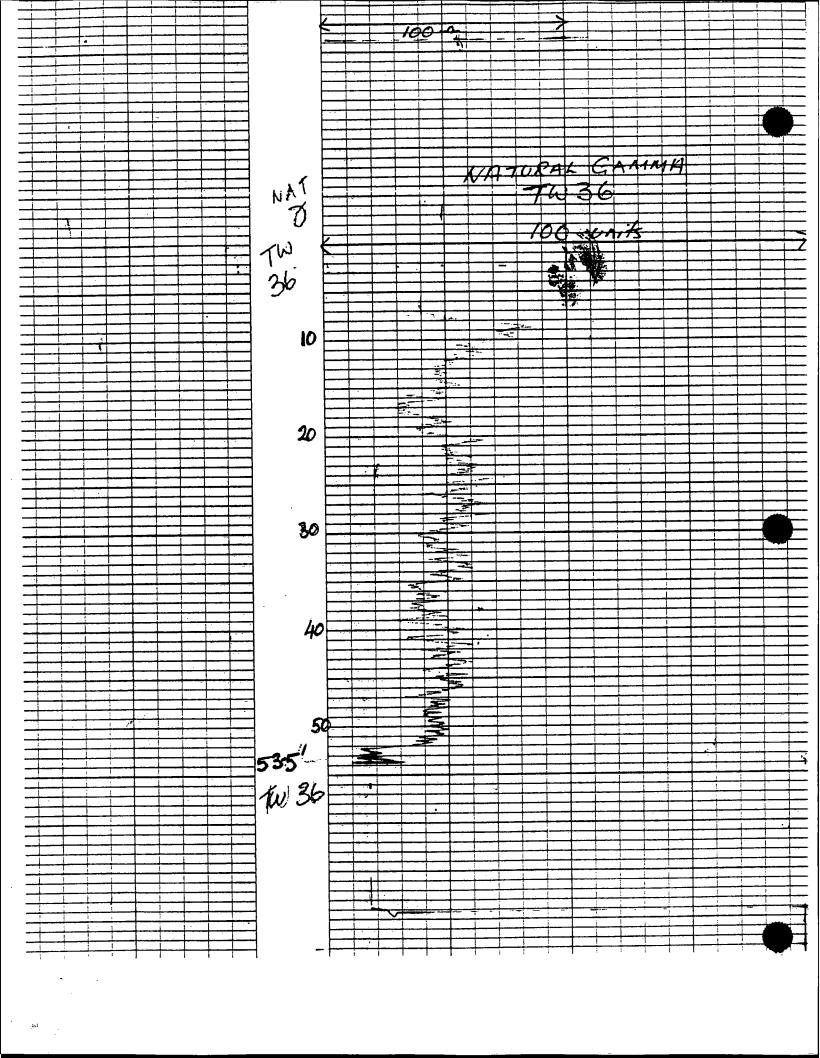


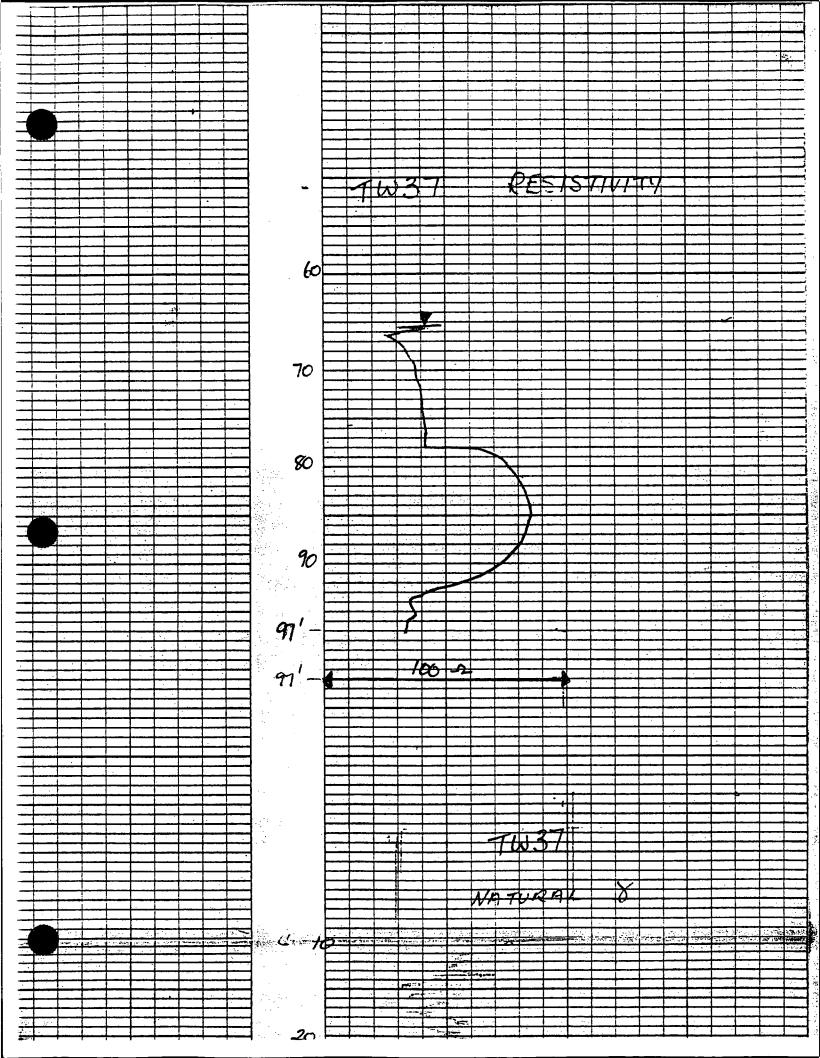


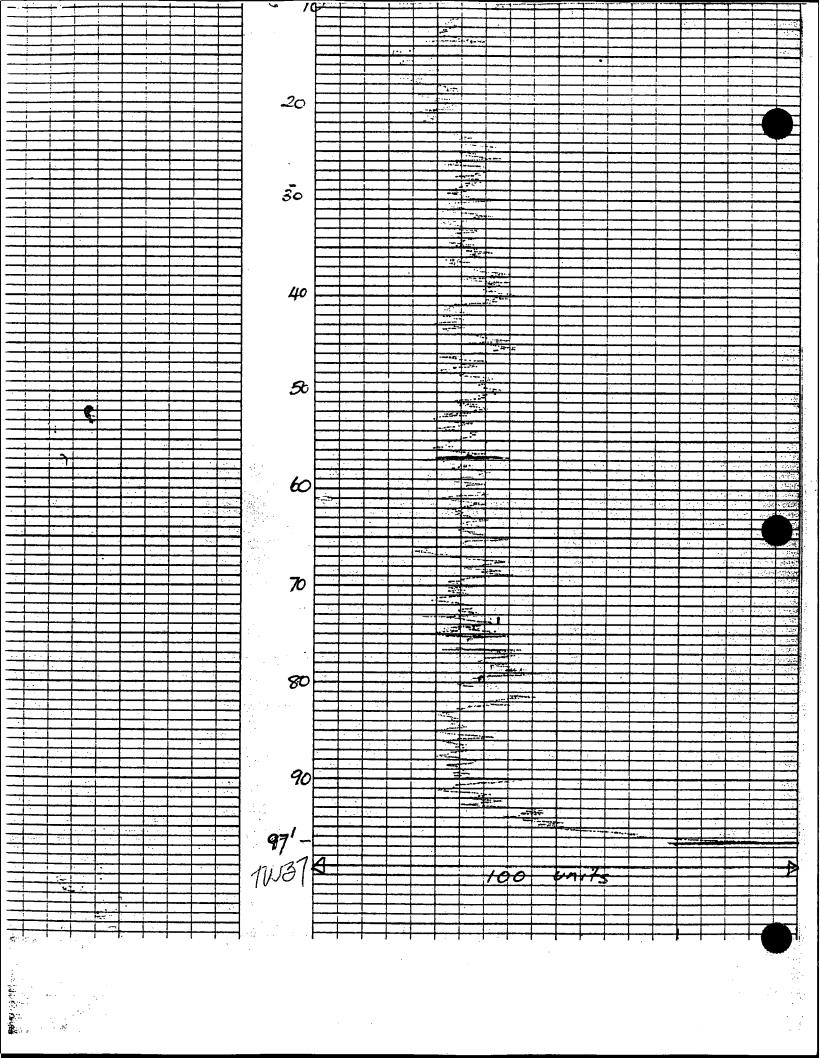


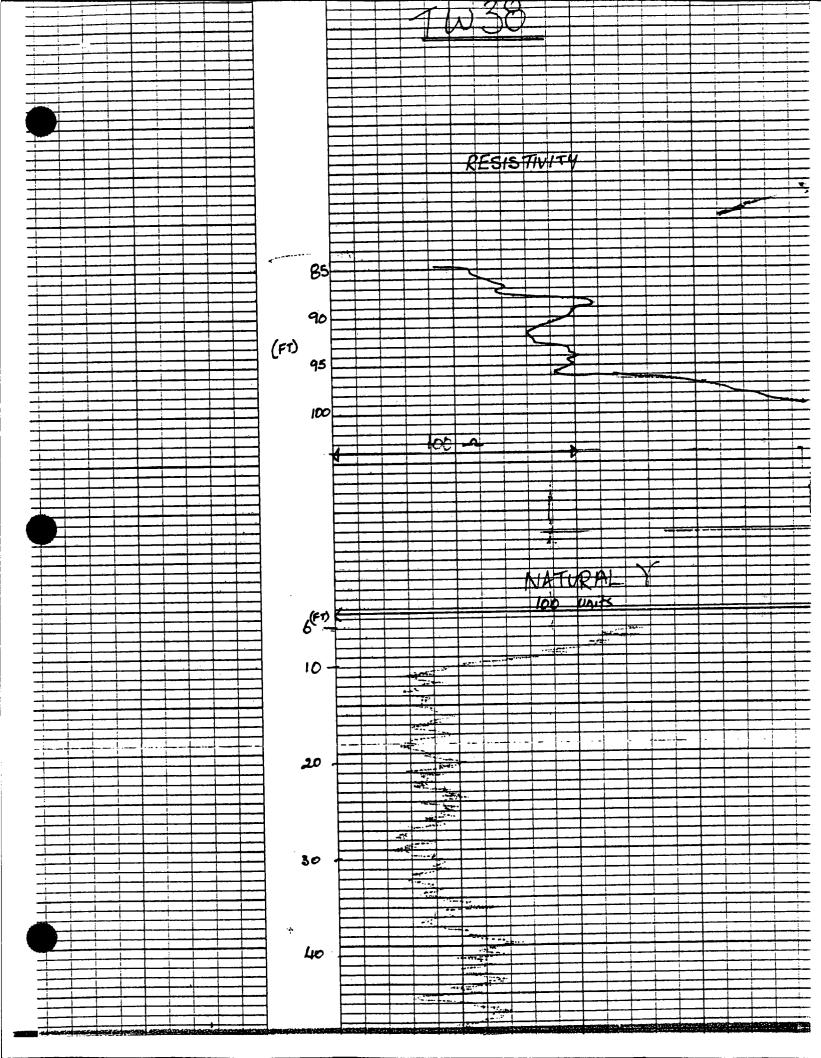


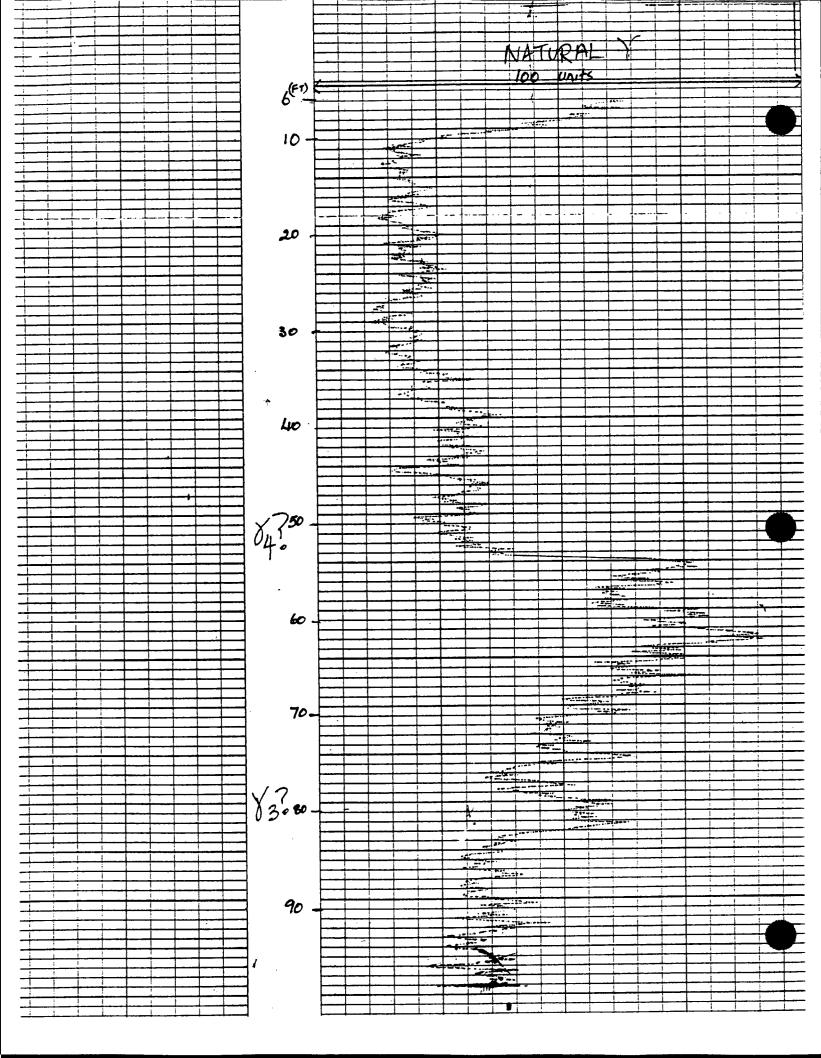


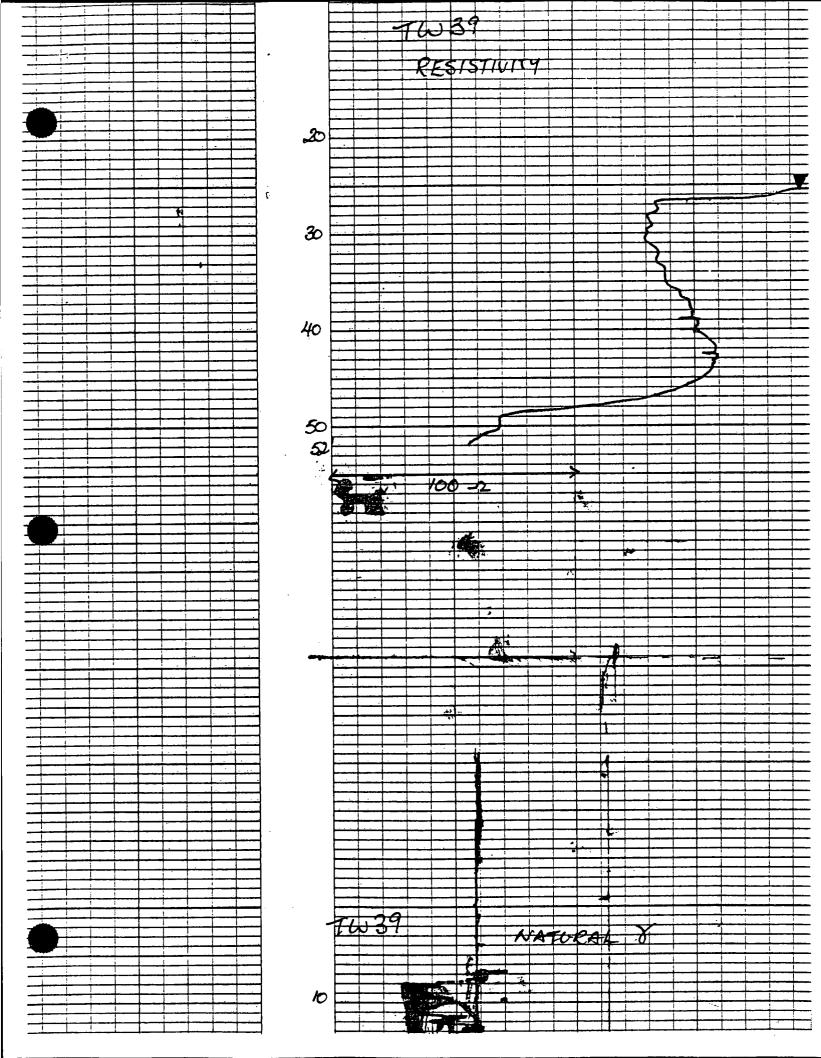


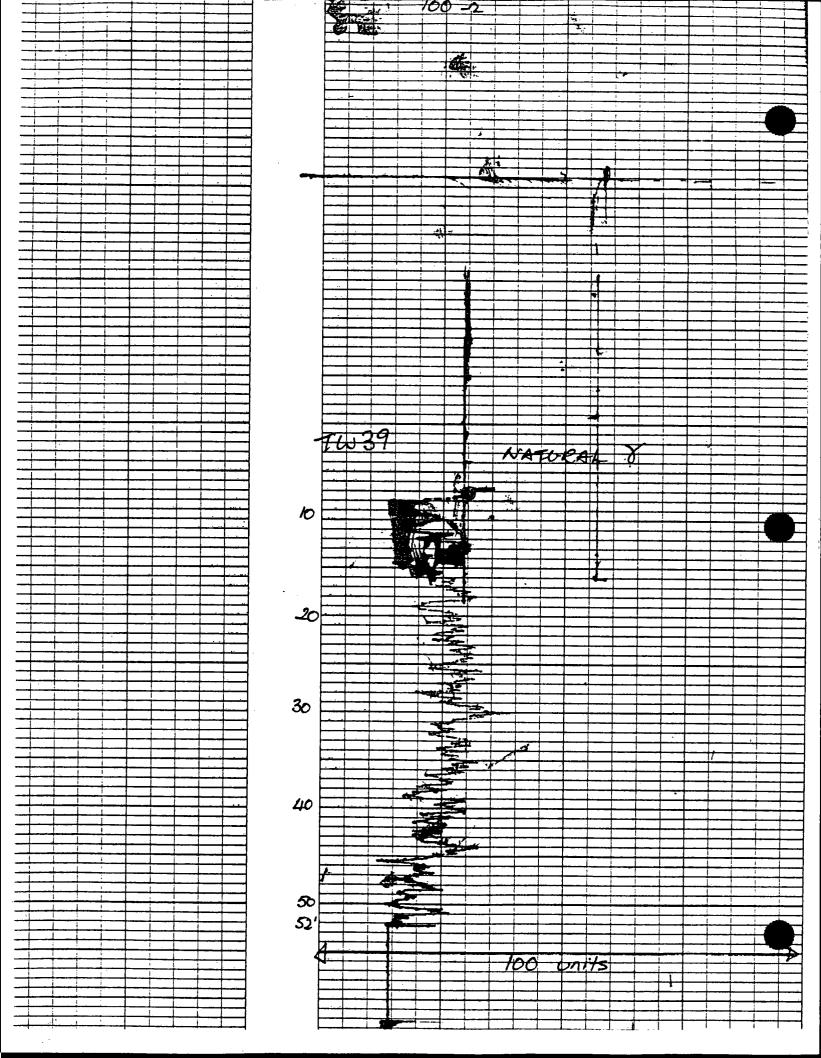


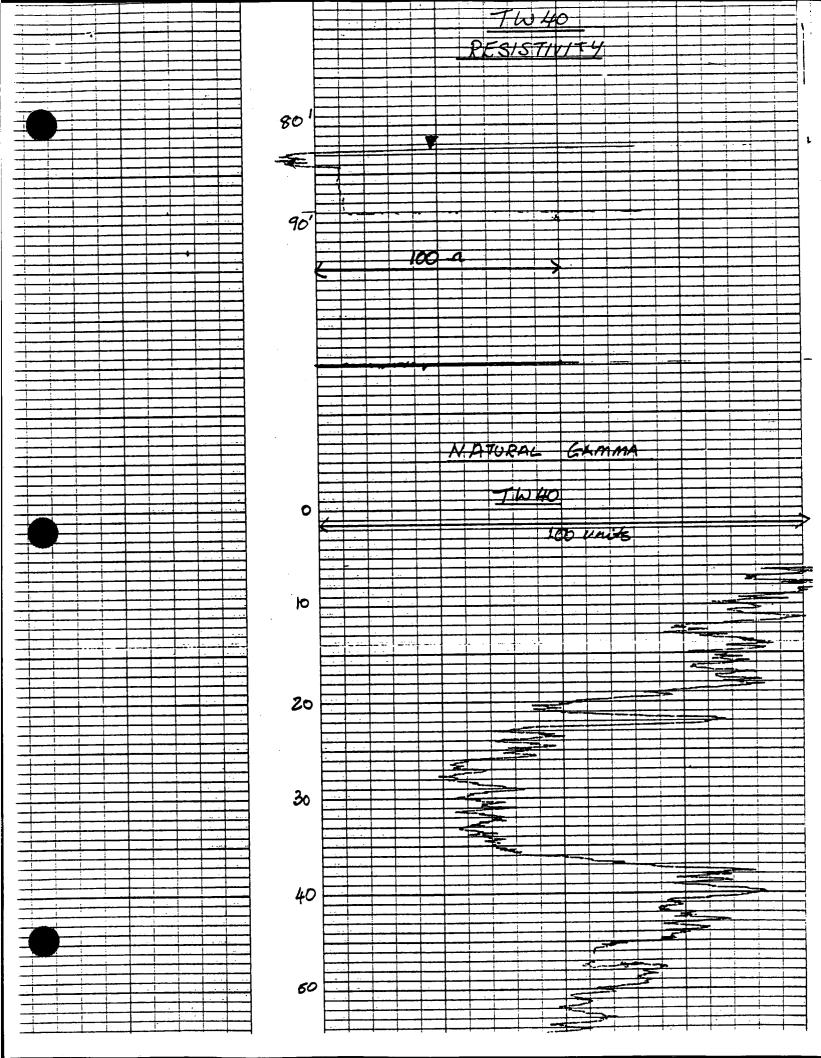


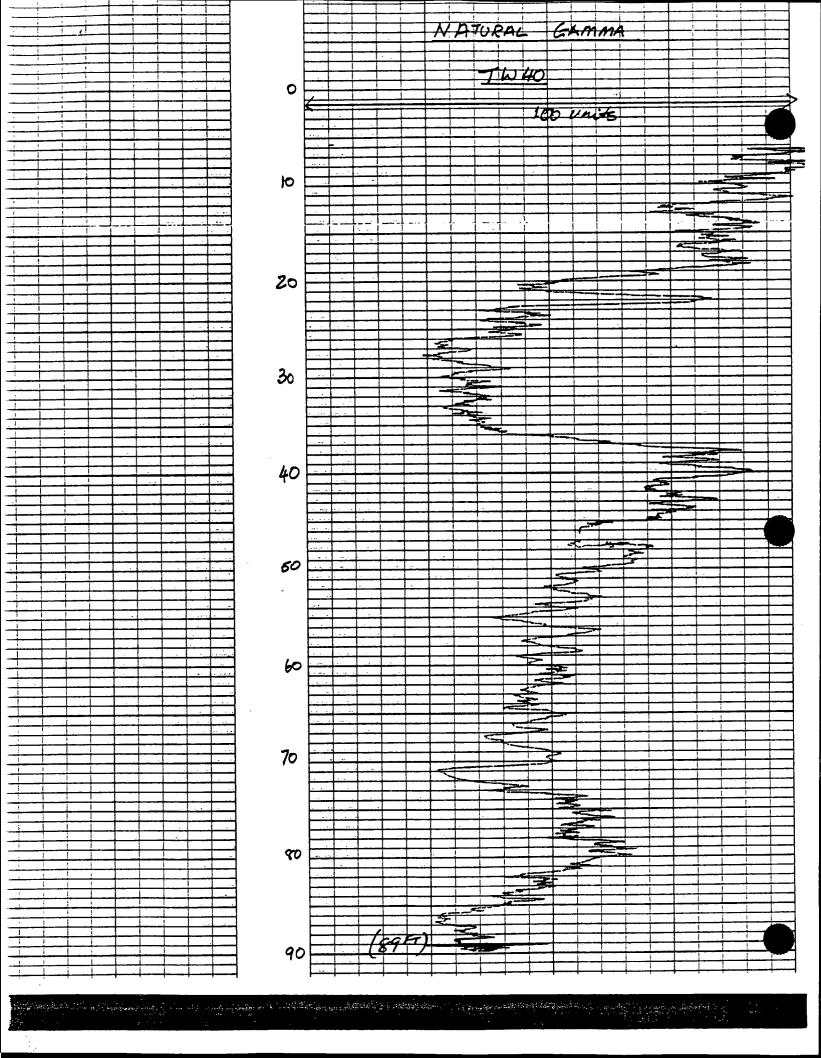












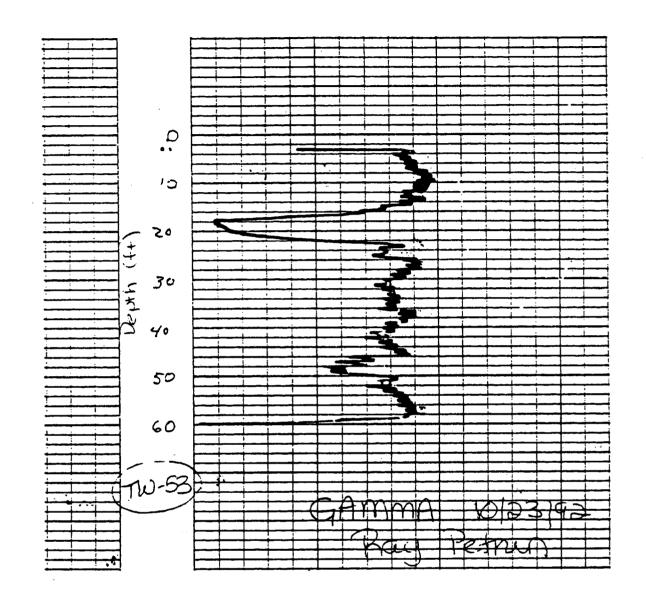


FIGURE B-1
NATURAL GAMMA LOG (PRIOR
TO WELL COMPLETION) - TW-53
MONSANTO/PHASE II RI/ID

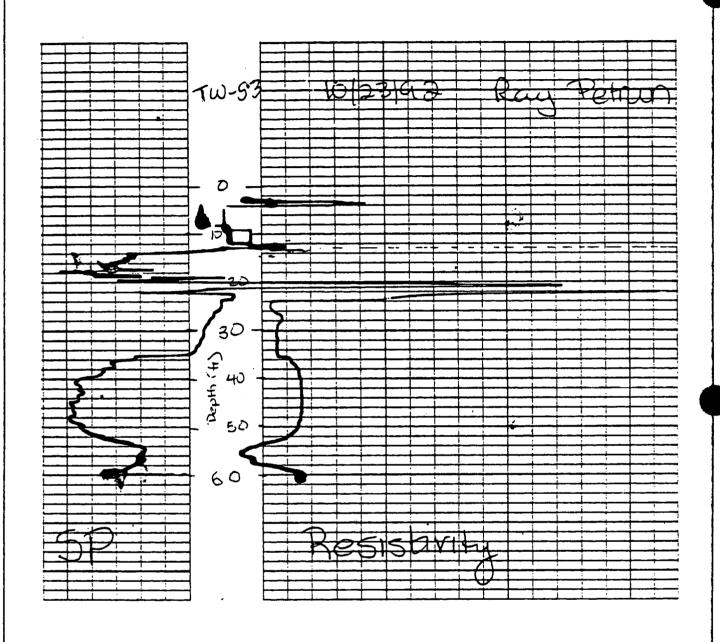
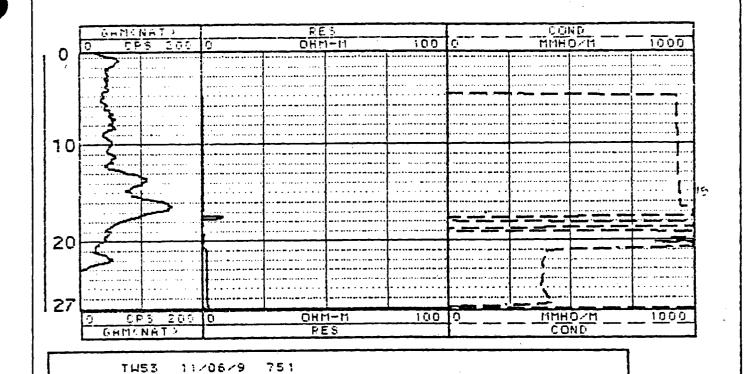


FIGURE B-2
RESISTIVITY AND SPONTANEOUS POTENTIAL
LOGS (PRIOR TO WELL COMPLETION) - TW-53
MONSANTO/PHASE II RI/ID



	ŢC	OCL CALIBRA	TION	100L = 951	IOC SER	RIAL NUMBER	751	
	CAL-DATE	CAL-TIME	SRCE	SENSOR	RESPONSE		STANDARD	
Ū 1 2 3	00101.92 00101.92 NOU04.92 NOU04.92	08:39:12 08:39:12 01:54:44 01:54:44	000	GAMCHAT? GAMCNAT? COND COND	0.000 0.000 47e00.000 113050.006	CPS CPS	0.000 0.000 10.000 490.000	fi A II M

LOGIZ

DB 11/6/92

Chayed

conductively

Scale

0-1,000

mucholm

FIGURE B-3
NATURAL GAMMA AND INDUCTION LOGS
(AFTER WELL COMPLETION) — TW-53
MONSANTO/PHASE II RIJID

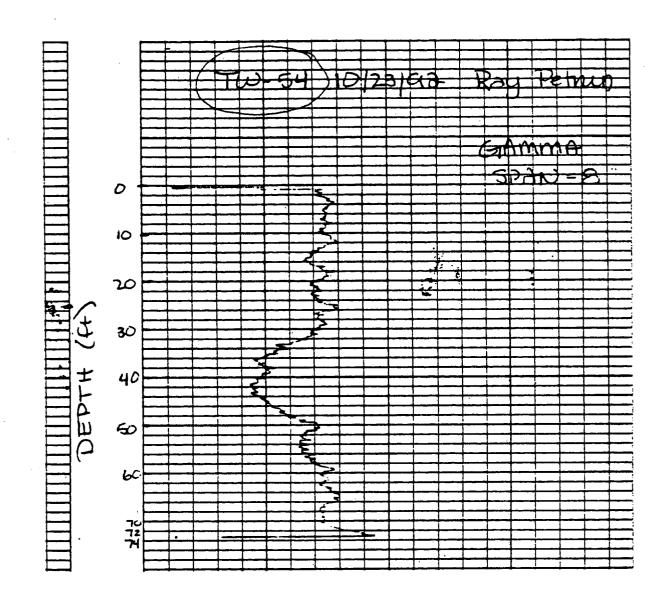


FIGURE B-4
NATURAL GAMMA LOG (PRIOR TO
WELL COMPLETION) - TW-54
MONSANTO/PHASE II RI/ID

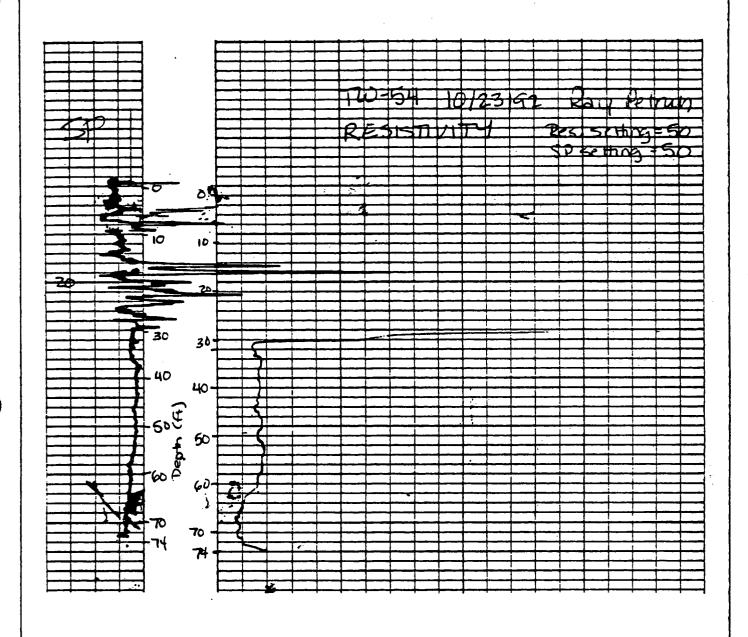
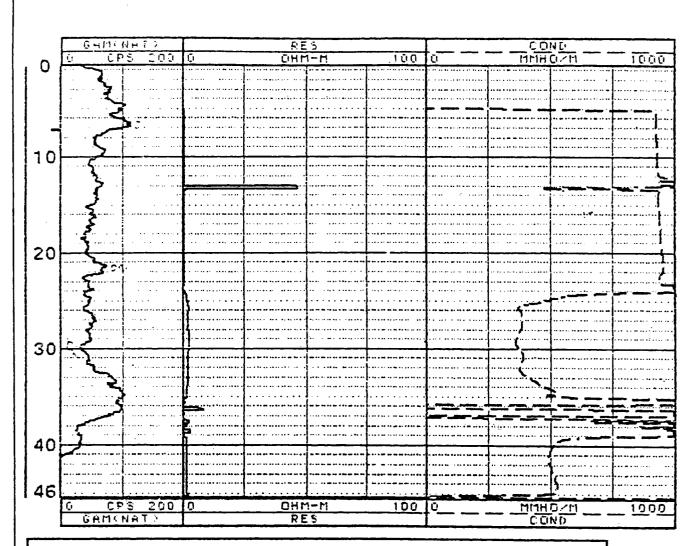


FIGURE B-5
RESISTIVITY AND SPONTANEOUS POTENTIAL LOGS (PRIOR TO WELL COMPLETION) - TW-54
MONSANTO/PHASE II RIVID



TUSA	11/06/9	75 1

	10	OL CALIBRA	TION	TDOL = 95100	SERIAL	NUMBER = 751	
	CAL-DATE	CAL-TIME	SRCE	SENSOR	RESPONSE	STANDARD	
0 1 2 3	OCTO1.92 OCTO1.92 NOUB4.92 NOUB4.92	08:39:12 05:39:12 01:54:44 01:54:44	0 0 0	GHMCNAT) CAMCHAT COND COND	0.000 CPS 0.000 CPS 47800.000 CPS 113050.000 CPS	0.090 0.000 10.000 490.000	•

LOGS

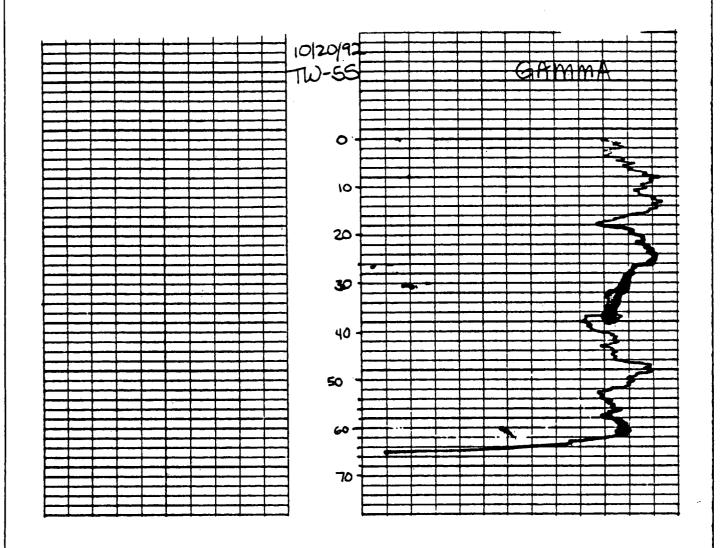
DB 1/6/92

Changed const

Scale

0-1,000

FIGURE B-6
NATURAL GAMMA AND INDUCTION LOG (AFTER WELL COMPLETION) — TW-5
MONSANTO/PHASE II RVID



Span=9
Total depth
=67
Ray Petnin

FIGURE .B-7
NATURAL GAMMA LOG (PRIOR TO WELL COMPLETION) — TW-55
MONSANTO/PHASE II RI/ID

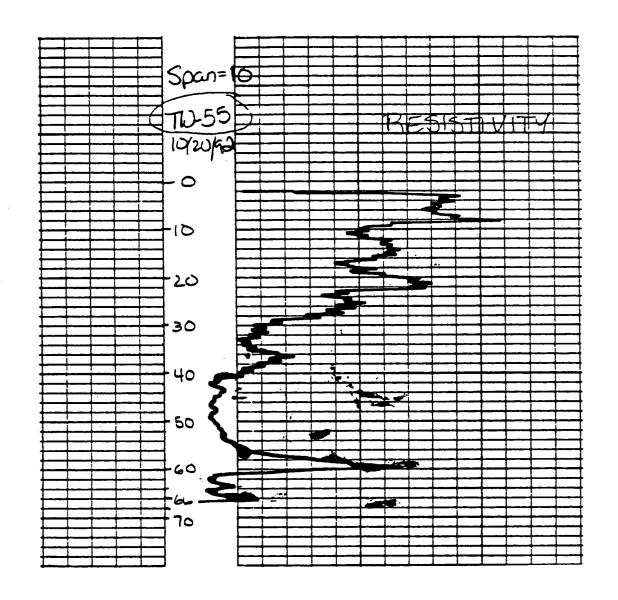


FIGURE B-8
RESISTIVITY LOG (PRIOR TO WELL COMPLETION) — TW-53
MONSANTO/PHASE II RIZID

COND MULLON

1000

200

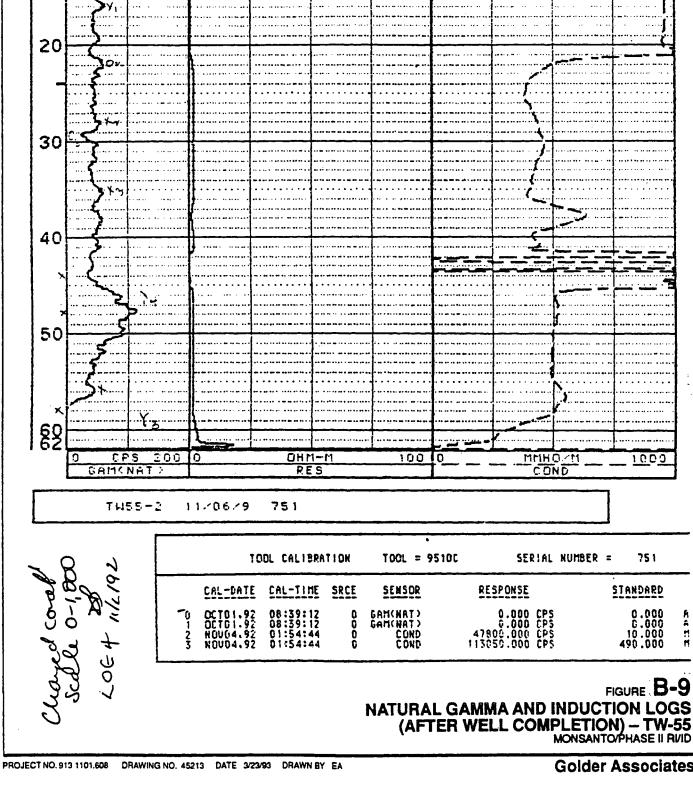
CP3

0

10

M-MHO

100



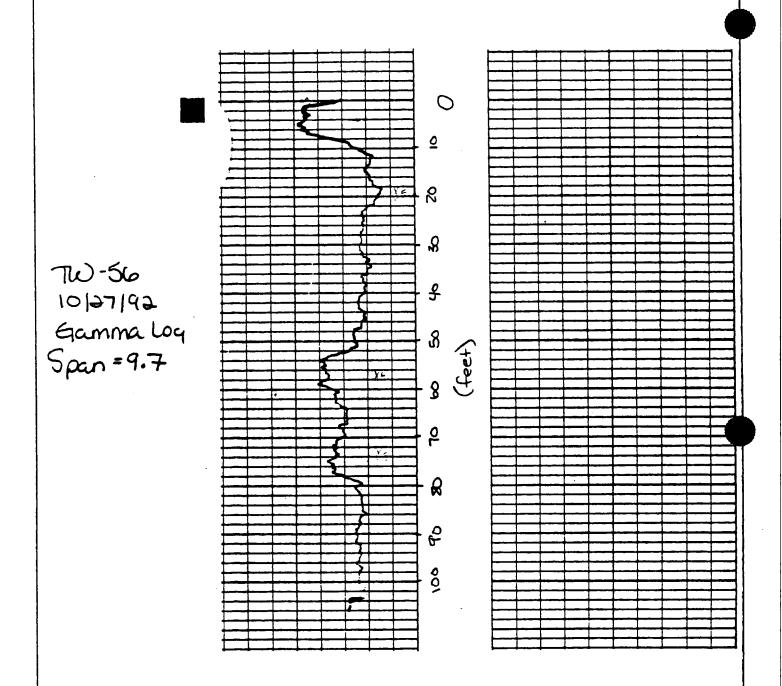
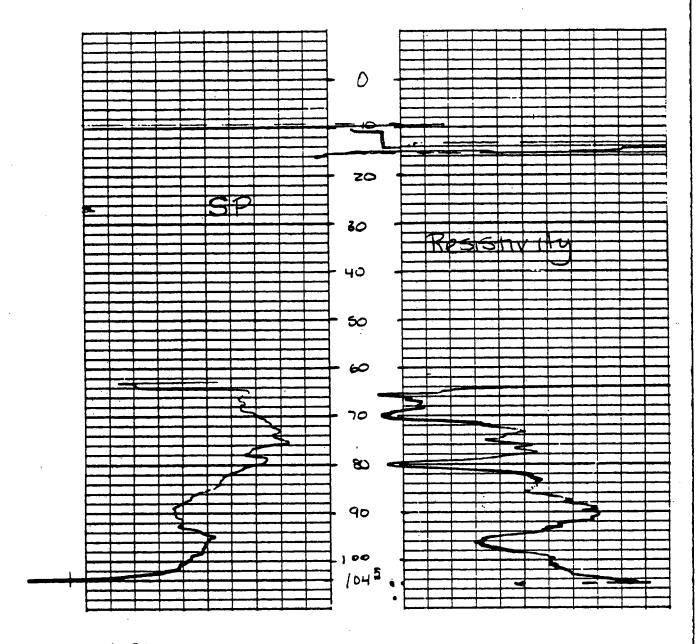


FIGURE B-10
NATURAL GAMMA LOG (PRIOR TO WELL COMPLETION) - TW-56
MONSANTO/PHASE II RI/ID



TW-56 10127192 6P & Res. to 1045 TD = 106 695

FIGURE B-11
RESISTIVITY AND SPONTANEOUS POTENTIAL
LOGS (PRIOR TO WELL COMPLETION) - TW-56
MONSANTO/PHASE II RI/ID

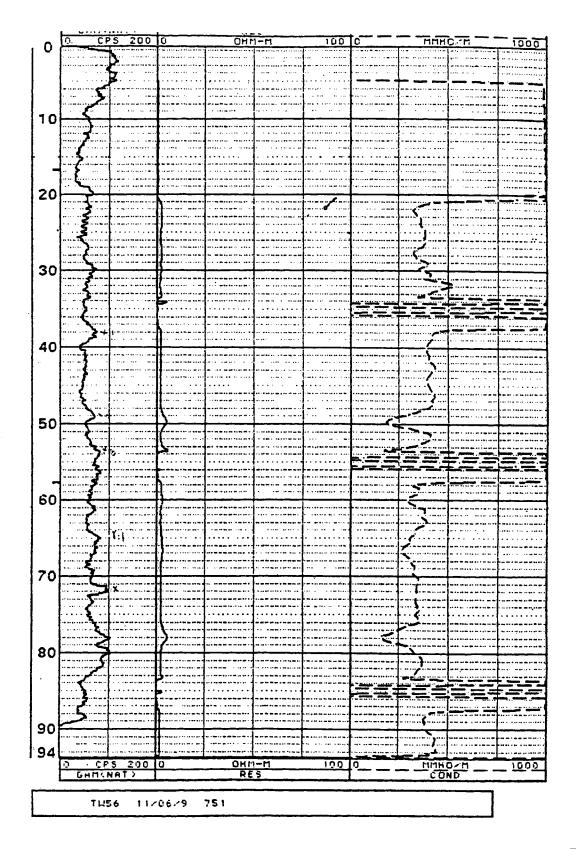


FIGURE B-12
NATURAL GAMMA AND INDUCTION LOGS
(AFTER WELL COMPLETION) - TW-56
MONSANTO/PHASE II RIVID

TW-57
Gamma log
10-23-92
Span 9.5
34.3 bgs

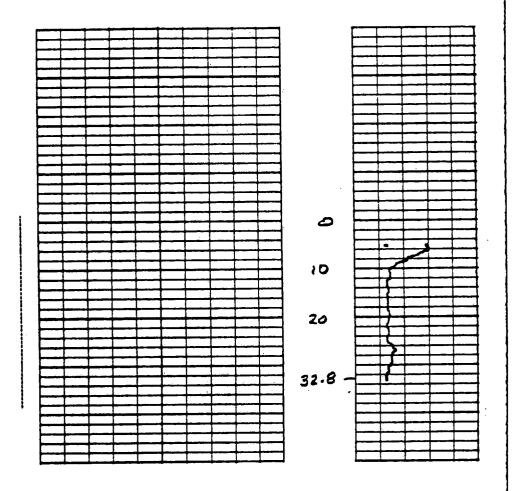
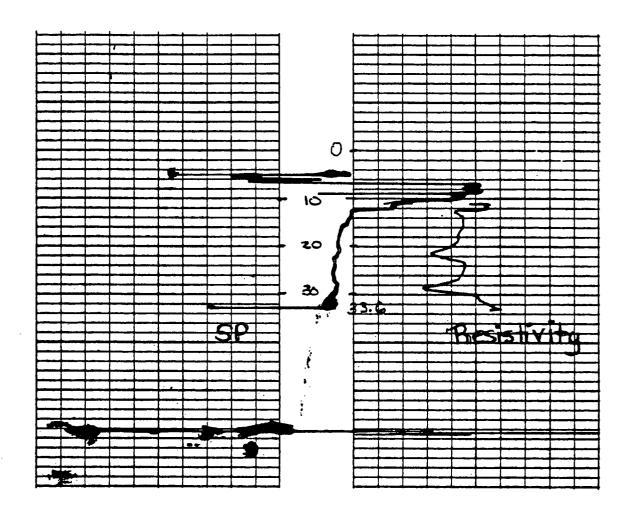


FIGURE B-13
NATURAL GAMMA LOG (PRIOR TO WELL COMPLETION) - TW-57
MONSANTO/PHASE II R/ID



TW-57
10-23-92
Span 8
Sp = res.
Se Hing = 20

TD 34.3 bg 5

FIGURE B-14
RESISTIVITY AND SPONTANEOUS POTENTIAL LOGS (PRIOR TO WELL COMPLETION) - TW-57
MONSANTO/PHASE II RIZID

#### APPENDIX H-3

GEODETIC SURVEY: ALL WELLS

Location	Northing	Easting	Ground Elevation	Measuring Point Elevation	Units	Measuring Point (MP)
				*************		
BOYSCOUT SPRING	366054.41	658946.89		5907.78	ft	Water surface
CALF SPRING	367966.12	654239.97		5858.47	ft	Water surface
DOC KACKLEY SPRING	368490.40	652014.93		5847.58	ft	Water surface
FINCH SPRING	367286.08	658455.28		5913.49	ft	Water surface
FORMATION SPRING	376564.29	667860.94		6149.26	ft	Water surface
HOMESTEAD SPRING	365703.56	653195.54		5815.86	ft	Water surface
HOOPER SPRING	369420.63	651592.41		5853.78	ft	Water surface
KELLY PARK SPRING	365348.11	659160.54		5897.72	ft	Water surface
LEDGER A SPRING	365444.23	659950.57		5917.38	ft	Water surface
LEDGER B SPRING	365264.77	660092.44		5911.08	ft	Water surface
LEDGER C SPRING	365114.50	660086.95		5905.28	ft	Water surface
MORMON A SPRING	367870.46	654111.71		5850.60	ft	Water surface
MORMON B SPRING	367814.11	653798.08		5843.55	ft	Water surface
MORMON C SPRING	367649.22	653446.85		5834.01	ft	Water surface
SOUTHWEST SPRING	369518.22	652795.12		5859.25	ft	Water surface
HARRIS WELL	368317.90	654651.32	5878.78	5877.56	ft	Top of steel 1" pipe
LEWIS WELL	366022.93	655889.54	5863.35	5864.35	ft	Top of steel well-cap
PW-01	372453.32	656074.00	5986.60	5987.37	ft	Small hole in well base
PW-02	371836.27	656082.36	5986.40		ft	No water-level access
PU-03	371587.10	656086.26	5988.60	5988.58	ft	Small hole in well base
PW-04	375506.05	655863.68	5990.80		ft	No water-level access
TW-02	375493.01	655588.76	5989.00	5989.06	ft	Top of steel casing
TW-03	369101.00	654233.00	5880.30		ft	Well abandoned
TW-04	369101.00	654233.00	5880.10		ft	Well abandoned
TW-05	372828.00	654238.00	5957.00		ft	Well abandoned
TW-06	372828.00	654238.00	5957.10		ft	Well abandoned
TU-07	369004.33	654371.73	5884.50	5885.11	ft	Top of PVC well cap
TU-08	369003.99	654360.29	5884.70	5884.88	ft	Top of PVC well cap
TW-09	368986.08	656682.08	5883.90	5884.91	ft	Top of coupling
TW-10	368989.74	654367.10	5884.40	5885.53	ft	Top of seal
TV-11	368986.08	656682.08	5936.60	5938.03	ft	Top of coupling
TW-12	369017.37	656681.35	5937.60	5939.23	ft	Top of seal
TW-13	374932.31	658465.83	5986.40	5988.15	ft	Top of seal
TV-14	374949.49	658474.42	5986.50	5988.59	ft	Top of PVC casing
TW-15	374947.60	658454.43	5986.50	5988.27	ft	Top of seal
TW-16	374541.55	654567.41	5996.90	5998.39	ft	Top of seal
TW-17	374539.37	654587.61	5996.40	5998.33	ft	Top of seal
TW-18	374520.88	654587.13	5994.60	5996.89	ft	Top of seal
TH-19	368984.85	655519.33	5891.20	5893.07	ft	Top of PVC casing
TW-20	368975.43	655503.64	5891.80	5893.37	ft	Top of seal
TW-21	368969.43	655528.89	5891.50	5893.68	ft	Top of coupling
TW-22	371421.14	654280.62	5952.40	5954.70	ft	Top of seal
TW-23	371421.83	654265.62	5952.40	5954.52	ft	Top of seal
TW-24	371435.86	654273.24	5952.50	5954.43	ft	Top of PVC casing
TW-25	372218.00	655264.00	5995.80	J7J7.4J		Well abandoned
		JJJE04.00	2772.00		1.6	METT BORINGOUSES

Location	Northing	Easting	Ground Elevation	Measuring Point Elevation	Units	Measuring Point (MP)
TW-26	372217.87	655264.35	5995.60	5991.42	ft	Top of seal
TW-27	372218.00	655264.00	5995.60	2771.76	ft	Well abandoned
TW-28	375486.33	654189.48	5987.00	5989.40	ft	Top of seal
TW-29	375471.82	654187.34	5987.70	5989.59	ft	Top of coupling
TW-30	373594.42	655794.00	5991.00	5992.73	ft	Top of coupling
TW-31	372539.79	657709.67	5973.90	5975.29	ft	Top of PVC casing
TW-32	372539.63	657696.82	5974.10	5975.91	ft	Top of coupling
TW-33	372526.92	657699.47	5974.00	5975.68	ft	Top of seal
TW-34	368993.91	655496.74	5891.60	5893.43	ft	Top of coupling
TW-35	369036.29	655076.56	5895.00	5897.16	ft	Top of seal
TW-36	369828.74	654892.25	5904.70	5906.81	ft	Top of seal
TW-37	372837.18	654245.63	5957.10	5959.17	ft	Top of seal
TW-38	370446.40	656523.94	5970.90	5972.91	ft	Top of PVC casing
TW-39	369036.99	655061.98	5895.00	5897.07	ft	Top of seal
TW-40	373122.39	655757.09	5988.30	5989.94	ft	Top of seal
TW-41	373505.54	655621.80	5991.50	5994.31	ft	Top of coupling
TW-42	373178.57	655840.05	5987.90	5990.07	ft	Top of seal
TW-43	373141.22	655697.28	5986.70	5989.12	ft	•
TW-44	373110.02	655766.66	5987.40	5989.41	ft	Top of seal
TW-45	372827.62	654238.16	5957.30			Top of seal
TW-48	375520.55	655978.20	5987.80	5959.17	ft	Top of coupling
TW-49	374930.77	656071.52	5995.90	5989.19	ft	Top of seal
TW-50				5996.94	ft	Top of seal
	373849.68	656040.74	5992.00	5992.94	ft	Top of seal
TW-51	374323.79	657503.66	5994.60	6001.57	ft	Top of ext. steel casing
TW-53	368055.24	654739.84	5878.35	5880.65	ft	Top of coupling
TW-54	368052.39	655240.53	5886.70	5889.21	ft	Top of coupling
TW-55	368050.24	655739.76	5884.33	5886.58	ft	Top of coupling
TW-56	367979.10	656276.06	5907.70	5910.20	ft	Top of coupling
TW-57	374365.91	654000.20	5950.36	5952.74	ft	Top of coupling
TW-58	368980.16	655458.20	5889.84	5892.74	ft	Top of steel casing

713-1101.201

## A. A. HUDSON

and

### **ASSOCIATES**



14166 CLEVELAND RD. PRESTON, IDAHO 83263 (208) 427-6214

40 EAST HOOPER AVE. SODA SPRINGS IDAHO 83276 (208) 547-4141

Mr. David Banton Golder Associates 4104 148 th Avenue NE Redmond, Washington 98052 NOV 2 6 1991

Golder Associates

November 21, 1991

Dear Mr. Banton,

I have completed the Monsanto Monitoring Well Survey and am forwarding the results to you with this letter. I am sending a hard copy of the coordinates and elevations of the wells and springs besides a computer disk with the same information in ASCII files.

All the surveys were completed to Third Order accuracy as required. The horizonal control was finished on November 14 and the vertical control was completed on November 20. We picked up the additional points you requested by phone and we also located the head of the Southwest Spring along with the point at the culvert that Bob Geddes said you were using as a measuring point. Bob Geddes showed us the measuring points at Formation Ponds and they are labelled in our coordinate list as A through E, with point C being the top of a rebar on the head gate structure.

Please review the data and let me know if you have any questions. It has been a pleasure performing this work for Golder Associates and Monsanto Company.

Aly Langue

Alex Hudson, PLS PE

Diss - vault-hydrology file dox

Diss - Vault-hydrology file dox

MH. 54 Floppy

## A. A. HUDSON

#### and

### **ASSOCIATES**



14166 CLEVELAND RD. PRESTON, IDAHO 83263 (208) 427-6214

40 EAST HOOPER AVE. SODA SPRINGS IDAHO 83276 (208) 547-4141

#### MONSANTO WELL ELEVATIONS

NUMBER	TOP OF STEEL PROTECTIVE CASING	MEASURING POINT	TOP OF CONCRETE
TW-7 TW-8 TW-9	5885.11 5884.88 5884.93	5885.11 5884.88	5883.31 5883.64 5883.02
TW-10	5885.74	5885.53	5883.97
TW-11	5937.93		5936.51
TW-12	5939.28	5939.23	5937.38
TW-13	5988.36		5985.92
TW-14	5988.75	5988.59	5986.04
TW-15	5988.46	5988.27	5985.88
TW-16 TW-17	5998.57 5998.54	5998.39	5996.26
TW-18	5997.03	5998.33 5996.89	5995.83 5994.14
TW-19	5893.24	5893.07	5890.74
TW-20	5893.48	5893.37	5890.92
TW-21	5893.62	5954.70	5890.86
TW-22	5954.92		5952.44
TW-23	5954.60	5954.43	5951.74
TW-24	5954.60		5952.13
TW-25 TW-26	5991.32	5991.42	5988.43
TW-27 TW-28	5989.65	5989.40	5986.45
TW-29	5989.62		5986.91
TW-30	5992.68		5990.04
TW-31	5975.53	5975.29	5973.15
TW-32	5975.85	5975.91	5973.40
TW-33	5975.84	5975.68	5973.57
TW-34	5893.51		5891.01
TW-35	5897.34	5897.16	5894.63
TW-36	5907.04	5906.81	5904.51
TW-37	5959.27	5959.17	5956.25
TW-38	5973.06	5972.91	5970.19
TW-39 TW-40	5897.26 5990.07	5897.07	5894.50
TW-41	5994.24	5989.94	5987.62
TW-42	5990.61		5991.45
TW-43 TW-44	5989.32 5989.60	5989.08	5987.91 5986.70 5987.41
TW-45	5959.17		5956.38

# MONSANTO WELL ELEVATIONS (CONT)

WELL Prote	TOP OF STEEL	MEASURING POINT	TOP OF CONCRETE
TW-46 TW-47			
TW-48 TW-49 TW-50 TW-51	5989.13 5997.06 5993.06 5995.57	5996.94 5992.94	5986.88 5994.93 5991.16
P W 1	5987.39 Elevati 5986.60 Elevati	on of top of SW bol on of top of concre	t on pump housing te
P W 2	5987.20 Elevati 5986.35 Elevati	on of top of NW bolon of top of concre	t on pump housing te
P W 3	pump no	on of top of steel ousing	
P W 4		on of top of concret	
4 H 3	base pla	on of top of NW bolt ate	on pump housing
SULFURIC ACID BLDG. WELL	5989.06		5988.52

Note: Harris's well elevation on coor. list is to the top of the 1" pipe that is protruding from the vertical casing. It is 5.0 ft. from the floor of the well house.

Coordinate File Name: SPCS.CRD Lowest pt #: 1 Highest pt #: 93 Job # : 91181

Description: COORD. AND ELEV. OF TEST WELLS, SPRINGS, TIE PTS., ETC., IN STATE P

LANE CRD.

# of chars. in point descr.: 30

FROM TYPE	BEARING	DISTANCE	TO	NORTHING	EASTING	
TICE DOTUMO						
LIST POINTS		DAGETIG		<b></b>		
POINI	NORTHING	EASTING		ELEVATION	DESCR	
1	368984.848	655510 221		E002 040	mr. 10	
				5893.240		
2 3 4 5 6 7 8	369975 429	655502 645		5893.510	TW-34	
<b>3</b>	368960 121	655500 000		5893.480	TW-20	
5	369036 289	655076 550		5893.620	TW-21	
6	369036.283	655061 004		5897.340	TW-35	
7	369004 331	65/271 721		5897.260	TW-39	
Ř	369003 987	654360 202		5000.110	TW-7	
9	368992.859	654347 200		5004.000	TW-8	
10	368989 741	65/367 006		5004.930	TW-9	
11	369045.752	654249 307		5885.740	TW-10	
	368993.915 368975.429 368969.431 369036.289 369036.991 369004.331 369003.987 368992.859 368989.741 369045.752	004240.037		0000.21U	IEME MOD OU O UD O	
12	369828.741	654892 254		5007 040	JENT TOP SW C HD GATE	
13	370243.174	654264 125		1-00-555	1 /0" DD #00	
	371435.863	654273 245		5054 600	1/2 KB #36	
	371421.831	654265 621		5954.600	TW 24	
	371421.142	654280 624		5954.920		
	374520.875	654587 131		5007 020	TW-22	
	374539.372	654587 610		5000 540	TW-10	
19	374541.553	654567 400		5998.570		
20	374930.767	656071 524		5007 060	TW-10	
21	374930.767 375520.551	655978 204		5090 120	TW-49	
22	375520.551 375494.273	655849.477		68.141	1 W-40	
		0000101111			LL HOUSE 4	
23	375514.520	655848.713		SWcWE <del>67.965</del>	ADD HOUSE 4	
				NW C W	ELL HOUSE 4	
24	375482.601	655577.988		NWc W <del>86.653</del>	EDD HOUSE 4	
				SEC S	ULFURIC ACID BLDG.	
25	375471.558	655558.734		SEc S <del>66.37</del> 5	objectic ACID BLDG.	
					ULFURIC ACID BLDG	
26	375485.524	655550.763		<del>66.27</del> 3	onic word bodg	
					ULFURIC ACID BLDG	
27	375486.326	654189.479		5989.650		
28	375471.819	654187.338		5989.620		
29	375501.586	654189.811		64 - 81-7		
		1			B OLD AT	
30	372827.616	654238.161		5959.170		
	372837.182	654245.632		5959.270		
	375506.052	655863.683			PLANT WELL 4	
33	375578.935	658840.806		0.000		
				FC AT	NEc PLANT	
	374947.598	658454.426		5988.460		
	374949.495	658474.424		5988.750		
	374932.313	658465.829		5988.360		
	374323.786	657503.663		5995.570	ΓW−51	
	372539.789	657709.675		5975.530		
	372539.633	657696.816		5975.850	ΓW-32	
	372526.916	657699.470		5975.840		
41	373849.676	656040.742		5993.060 7	TW-50	

42 43 44 45 46 47 48	373505.539 372217.867 373141.225 373122.393 373110.017 373178.566	655264.352 655697.276 655757.088 655766.662 655840.053	5991.320 TW-26 5989.320 TW-43 5990.070 TW-40 5989.600 TW-44 5990.610 TW-42
49	372453.322	656074.004	5987.390 PLANT WELL 1
50	372486.244	656012.727	0.000 MONSANTO CP
51 52	371726.426		0.000 MONSANTO CP 5987.200 PLANT WELL 2
53			5989.000 PLANT WELL 2
54	371600.289	656081.343	0.000 PLANT WELL 3
			NWc WELL HOUSE 3
55	371600.580	656099.834	0.000 NEc WELL HOUSE 3
56	371581.936	656100.134	0.000
			SEc WELL HOUSE 3
	370446.403		· · · · · · · · · · · · · · · · · · ·
58	369054.975	656717.012	0.000
POINT	NORTHING	EASTING	1/2"RB OLD AT
FOINI	DATATA	EASIING	ELEVATION DESCR
59	369017.372	656681.352	5939.280 TW 12
60	368986.082	656682.079	5937.930 TW-11
61	368967.395	656729.673	0.000
			FC AT SEC PLANT
62	368490.397	652014.933	
63	369420.630	651500 410	KAKLEY SPRING
03	309420.030	651592.412	5853.780 HOOPER SPRING
64	369518.224	652795.118	
65	368317.898	654651.321	5878.780
66	367286.077	658455.282	HARRIS WELL SWG-SEE ELEV SHT. 5913.490 FINCH SPRING
67	365348.111	659160.539	5897.720 CULVERT KELLY/GOLDER
68	365916.354	659001.186	5907.220 KELLY SPRING 2
69	366054.408	658946.892	5907.780
70	366346.214	659716.466	BOYSCOUT SPRING 5969.220
71	365464.446	659904.477	FISH POND ABOVE LEDGE SPRINGS 5917.380
72	365444.232	659950.571	SPRING HOUSE 5 WATER ELEV
73	365264.769	660092.442	SPRING HOUSE 5 WATER ELEV 5911.080 SPRING HOUSE 4 WATER ELEV
74	365178.385	660146.926	5914.290 SPRING HOUSE 4 WATER ELEV.
75	365114.495	660086.945	5905.280 SPRING HOUSE 2 WATER ELEV.
76	364680.754	660325.425	5903.680 SPRING HOUSE 1 (LOWEST) WATER
77 78	367966.118 367997.695	654239.966	5858.470 CALF SPRING
10	001331.033	654139.602	MODMON A SDRING USE
79	367870.457	654111.708	MORMON A SPRING HSE 5850.600

0.0	000014 114		MORMON SPRING A OVERFLOW PIPE
80	367814.111	653798.076	5843.550
0.1	0.5.5.0.4.0.0.0.4		MORMON SPRING B
81	367649.224	653446.845	5834.010
0.0			MORMON SPRING C
82	368958.797	652909.892	5855.460
			N END CULVERT SW SPRING
83	365703.561	653195.543	5815.860
0.4	000000		HOMESTEAD SPRING
84	366022.932	655889.539	5864.350 LEWIS WELL
85	376557.506	668070.101	100.023
			CONC. SPRING BOX
86	375295.382	665414.327	6123.880
			FORMATION POND A
87	375665.675	665346.062	6124.840
			FORMATION POND B
88	375762.270	665252.062	6126.410 HEADGATE C
89	375851.123	664970.449	6122.420
			FORMATION POND D
90	376109.191	664894.865	6119.890
			FORMATION POND E
91	376564.275	667860.939	6149.260
			FORMATION SPRING
92	373836.614	664262.729	6068.750
			POND S OF RD.
93	375493.007	655568.762	
			WELL 2 SULFURIC

Coordinate File Name: MONCONTR.CRD Lowest pt #: 1 Highest pt #: 93

Job # : 91181
Description: COORD. AND ELEVATIONS OF TEST WELLS, SPRINGS, TIE PTS., ETC.

# of chars. in point descr.: 30

		in point descr				
	OM TYPE	BEARING	DISTANCE	TO	NORTHING	EASTING
	T POINTS	NODWITNO	DAGETVA		7. 7	
PO	IN <b>T</b> 	NORTHING	EASTING		ELEVATION	DESCR
	1	7365.118			5893.240	
	2	7374.513			5893.510	
	3	7355.923 7349.560			5893.480	
		7422.948			5893.620 5897.340	
	6	7423.860	-11797.624			
	7	7401.135	-12488.490		5885.110	
	8	7400.956	-12499.936		5884.880	
	9	7390.014	-12513.092		5884.930	TW-9
	10	7386.609	-12493.336		5885.740	TW-10
	11	7444.342	-12611.253			
	12	0010 010	11055 005		EFFLU 5907.040	ENT TOP SW C HD GATE
	13	8218.219 8641.785	-11955.985 -12578.274		5907.040	
	14	9834.590	-12578.274		5954.600	1/2" RB #36
	15	9820.665			5954.600	
	16	9819.759	-12544.804		5954.920	
	17	12915.720	-12193.585		5997.030	
	18	12934.213				
	19	12936.686				
	20 21	13304.315 13895.566				
	22	13871.137			5989.130 0.000	TW-48
		100/11/10/	10010.001			LL HOUSE 4
	23	13891.399	-10917.429		0.000	22 110032 4
						ELL HOUSE 4
	24	13863.373	-11188.670		0.000	
	95	10050 005	11000 007			ULFURIC ACID BLDG.
	25	13852.605	-11208.087		0.000	
	26	13866.689	-11215.858		0.000	ULFURIC ACID BLDG
		20000.000	11210.000			ULFURIC ACID BLDG
	27	13887.099	-12577.413		5989.650	
	28	13872.619	-12579.763		5989.620	·
	29	13902.356	-12576.861		0.000	
	20	11007 107	10707 017			B OLD AT
	30 31	11227.137 11236.597	-12567.017		5959.170	
	32	13882.713	-12559.406 -10902.578		5959.270	
	33	13912.728	-7923.788		0.000	PLANT WELL 4.
			10201100			NEC PLANT
	34	13286.826	-8319.342		5988.460	
	35	13288.435	-8299.313		5988.750	
	36	13271.373	-8308.157		5988.360	
	37 38	12676.579 10889.246	-9279.288		5995.570	
	39	10889.246	-9098.930 -9111.794		5975.530	
	40	10876.517	-9109.322		5975.850 T	
	41	12223.444	-10749.341		5993.060 T	

42			
	11971.684	-10999.814	5992.680 TW-30
43			
	11885.270		5994.240 TW-41
44	10602.480	-11549.396	5991.320 TW-26
45		-11103.083	
			1001020 2 10
46		-11043.529	
47	11487.579	-11034.131	5989.600 TW-44
48		-10959.738	
49	10826.321	-10736.185	5987.390 PLANT WELL 1
50	10860.133	-10797.000	0.000 MONSANTO CP
51		-10797.000	
	10100.000	-10797.000	0.000 MONSANTO CP
5 <b>2</b>	10209.019	-10736.715	5987.200 PLANT WELL 2
53	9959.746	-10736.405	5989.000 PLANT WELL 3
54	9973.006		
54	9973.000	-10741.131	0.000
			NWc WELL HOUSE 3
55	9973.031	-10722.633	
	3373.031	-10722.633	0.000
			NEc WELL HOUSE 3
56	9954.379	-10722.601	0.000
		10,22,001	
			SEc WELL HOUSE 3
5 <b>7</b>	8812.505	-10315.064	5973.060 TW 38
58	7418.009	-10141.994	0.000
		-10141.334	
			1/2"RB OLD AT
POINT	NORTHING	EASTING	ELEVATION DESCR
			DEDUKTION DESCR
FΛ	7000 010	4445	
59	7380.912	-10178.203	5939.280 TW 12
60	7349.605	-10177.926	5937.930 TW-11
61	7330.228		
01	1330.228	-10130.592	0.000
			FC AT SEC PLANT
62	6921.043	-14853.179	
	0021.040	14000.175	
			KAKLEY SPRING
63	7857.555	-15262.388	5853.780
C 4	5005 045	4.475	HOOPER SPRING
64	7937.845	-14058.027	5859.250
			SW SPRING IN FIELD
65	6710.534	10010 500	SW SPRING IN FIELD
00	0/10.034		
	0.20.00.	12210.750	5878.780
		12210.750	
66			HARRIS WELL SWG-SEE ELEV.SHT.
66	5623.706	-8428.843	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING
66 67			HARRIS WELL SWG-SEE ELEV.SHT.
	5623.706	-8428.843	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720
67	5623.706 3675.180	-8428.843 -7751.355	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720 CULVERT KELLY/GOLDER
	5623.706	-8428.843	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720 CULVERT KELLY/GOLDER 5907.220
67 68	5623.706 3675.180 4245.836	-8428.843 -7751.355	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720 CULVERT KELLY/GOLDER 5907.220
67	5623.706 3675.180 4245.836	-8428.843 -7751.355 -7902.556	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720 CULVERT KELLY/GOLDER 5907.220 KELLY SPRING 2
67 68	5623.706 3675.180	-8428.843 -7751.355	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720 CULVERT KELLY/GOLDER 5907.220 KELLY SPRING 2 5907.780
67 68 69	5623.706 3675.180 4245.836 4384.701	-8428.843 -7751.355 -7902.556 -7954.873	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720 CULVERT KELLY/GOLDER 5907.220 KELLY SPRING 2
67 68	5623.706 3675.180 4245.836	-8428.843 -7751.355 -7902.556	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720 CULVERT KELLY/GOLDER 5907.220 KELLY SPRING 2 5907.780 BOYSCOUT SPRING
67 68 69	5623.706 3675.180 4245.836 4384.701	-8428.843 -7751.355 -7902.556 -7954.873	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720 CULVERT KELLY/GOLDER 5907.220 KELLY SPRING 2 5907.780 BOYSCOUT SPRING 5969.220
67 68 69 70	5623.706 3675.180 4245.836 4384.701 4665.482	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720 CULVERT KELLY/GOLDER 5907.220 KELLY SPRING 2 5907.780 BOYSCOUT SPRING 5969.220 FISH POND ABOVE LEDGE SPRINGS
67 68 69	5623.706 3675.180 4245.836 4384.701	-8428.843 -7751.355 -7902.556 -7954.873	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720 CULVERT KELLY/GOLDER 5907.220 KELLY SPRING 2 5907.780 BOYSCOUT SPRING 5969.220
67 68 69 70	5623.706 3675.180 4245.836 4384.701 4665.482	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720 CULVERT KELLY/GOLDER 5907.220 KELLY SPRING 2 5907.780 BOYSCOUT SPRING 5969.220 FISH POND ABOVE LEDGE SPRINGS 5917.380
67 68 69 70 71	5623.706 3675.180 4245.836 4384.701 4665.482 3780.824	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936 -7005.587	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720  CULVERT KELLY/GOLDER 5907.220  KELLY SPRING 2 5907.780  BOYSCOUT SPRING 5969.220  FISH POND ABOVE LEDGE SPRINGS 5917.380  SPRG. HOUSE 5 WATER ELEV.
67 68 69 70	5623.706 3675.180 4245.836 4384.701 4665.482	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720  CULVERT KELLY/GOLDER 5907.220  KELLY SPRING 2 5907.780  BOYSCOUT SPRING 5969.220  FISH POND ABOVE LEDGE SPRINGS 5917.380  SPRG. HOUSE 5 WATER ELEV. 5917.380
67 68 69 70 71 72	5623.706 3675.180 4245.836 4384.701 4665.482 3780.824 3759.941	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936 -7005.587	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720  CULVERT KELLY/GOLDER 5907.220  KELLY SPRING 2 5907.780  BOYSCOUT SPRING 5969.220  FISH POND ABOVE LEDGE SPRINGS 5917.380  SPRG. HOUSE 5 WATER ELEV. 5917.380
67 68 69 70 71	5623.706 3675.180 4245.836 4384.701 4665.482 3780.824	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936 -7005.587 -6959.775	HARRIS WELL SWG-SEE ELEV.SHT. 5913.490 FINCH SPRING 5897.720  CULVERT KELLY/GOLDER 5907.220  KELLY SPRING 2 5907.780  BOYSCOUT SPRING 5969.220  FISH POND ABOVE LEDGE SPRINGS 5917.380  SPRG. HOUSE 5 WATER ELEV. 5917.380  SPRING HOUSE 5 WATER ELEV.
67 68 69 70 71 72	5623.706 3675.180 4245.836 4384.701 4665.482 3780.824 3759.941	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936 -7005.587	HARRIS WELL SWG-SEE ELEV.SHT.  5913.490 FINCH SPRING  5897.720  CULVERT KELLY/GOLDER  5907.220  KELLY SPRING 2  5907.780  BOYSCOUT SPRING  5969.220  FISH POND ABOVE LEDGE SPRINGS  5917.380  SPRG. HOUSE 5 WATER ELEV.  5917.380  SPRING HOUSE 5 WATER ELEV.  5911.080
67 68 69 70 71 72 73	5623.706 3675.180 4245.836 4384.701 4665.482 3780.824 3759.941 3578.397	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936 -7005.587 -6959.775 -6820.459	HARRIS WELL SWG-SEE ELEV.SHT.  5913.490 FINCH SPRING  5897.720  CULVERT KELLY/GOLDER  5907.220  KELLY SPRING 2  5907.780  BOYSCOUT SPRING  5969.220  FISH POND ABOVE LEDGE SPRINGS  5917.380  SPRG. HOUSE 5 WATER ELEV.  5917.380  SPRING HOUSE 5 WATER ELEV.  5911.080  SPRING HOUSE 4 WATER ELEV.
67 68 69 70 71 72	5623.706 3675.180 4245.836 4384.701 4665.482 3780.824 3759.941	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936 -7005.587 -6959.775	HARRIS WELL SWG-SEE ELEV.SHT.  5913.490 FINCH SPRING  5897.720  CULVERT KELLY/GOLDER  5907.220  KELLY SPRING 2  5907.780  BOYSCOUT SPRING  5969.220  FISH POND ABOVE LEDGE SPRINGS  5917.380  SPRG. HOUSE 5 WATER ELEV.  5917.380  SPRING HOUSE 5 WATER ELEV.  5911.080  SPRING HOUSE 4 WATER ELEV.
67 68 69 70 71 72 73	5623.706 3675.180 4245.836 4384.701 4665.482 3780.824 3759.941 3578.397	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936 -7005.587 -6959.775 -6820.459	HARRIS WELL SWG-SEE ELEV.SHT.  5913.490 FINCH SPRING  5897.720  CULVERT KELLY/GOLDER  5907.220  KELLY SPRING 2  5907.780  BOYSCOUT SPRING  5969.220  FISH POND ABOVE LEDGE SPRINGS  5917.380  SPRG. HOUSE 5 WATER ELEV.  5917.380  SPRING HOUSE 5 WATER ELEV.  5911.080  SPRING HOUSE 4 WATER ELEV.  5914.290
67 68 69 70 71 72 73	5623.706 3675.180 4245.836 4384.701 4665.482 3780.824 3759.941 3578.397 3491.211	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936 -7005.587 -6959.775 -6820.459 -6767.209	HARRIS WELL SWG-SEE ELEV.SHT.  5913.490 FINCH SPRING  5897.720  CULVERT KELLY/GOLDER  5907.220  KELLY SPRING 2  5907.780  BOYSCOUT SPRING  5969.220  FISH POND ABOVE LEDGE SPRINGS  5917.380  SPRG. HOUSE 5 WATER ELEV.  5917.380  SPRING HOUSE 5 WATER ELEV.  5911.080  SPRING HOUSE 4 WATER ELEV.  5914.290  SPRING HOUSE 3 WATER ELEV.
67 68 69 70 71 72 73	5623.706 3675.180 4245.836 4384.701 4665.482 3780.824 3759.941 3578.397	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936 -7005.587 -6959.775 -6820.459	HARRIS WELL SWG-SEE ELEV.SHT.  5913.490 FINCH SPRING  5897.720  CULVERT KELLY/GOLDER  5907.220  KELLY SPRING 2  5907.780  BOYSCOUT SPRING  5969.220  FISH POND ABOVE LEDGE SPRINGS  5917.380  SPRG. HOUSE 5 WATER ELEV.  5917.380  SPRING HOUSE 5 WATER ELEV.  5911.080  SPRING HOUSE 4 WATER ELEV.  5914.290
67 68 69 70 71 72 73	5623.706 3675.180 4245.836 4384.701 4665.482 3780.824 3759.941 3578.397 3491.211	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936 -7005.587 -6959.775 -6820.459 -6767.209	HARRIS WELL SWG-SEE ELEV.SHT.  5913.490 FINCH SPRING  5897.720  CULVERT KELLY/GOLDER  5907.220  KELLY SPRING 2  5907.780  BOYSCOUT SPRING  5969.220  FISH POND ABOVE LEDGE SPRINGS  5917.380  SPRG. HOUSE 5 WATER ELEV.  5917.380  SPRING HOUSE 5 WATER ELEV.  5911.080  SPRING HOUSE 4 WATER ELEV.  5914.290  SPRING HOUSE 3 WATER ELEV.  5905.280
67 68 69 70 71 72 73 74	5623.706 3675.180 4245.836 4384.701 4665.482 3780.824 3759.941 3578.397 3491.211 3428.172	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936 -7005.587 -6959.775 -6820.459 -6767.209 -6828.122	HARRIS WELL SWG-SEE ELEV.SHT.  5913.490 FINCH SPRING  5897.720  CULVERT KELLY/GOLDER  5907.220  KELLY SPRING 2  5907.780  BOYSCOUT SPRING  5969.220  FISH POND ABOVE LEDGE SPRINGS  5917.380  SPRG. HOUSE 5 WATER ELEV.  5917.380  SPRING HOUSE 5 WATER ELEV.  5911.080  SPRING HOUSE 4 WATER ELEV.  5914.290  SPRING HOUSE 3 WATER ELEV.  5905.280  SPRING HOUSE 2 WATER ELEV.
67 68 69 70 71 72 73	5623.706 3675.180 4245.836 4384.701 4665.482 3780.824 3759.941 3578.397 3491.211	-8428.843 -7751.355 -7902.556 -7954.873 -7180.936 -7005.587 -6959.775 -6820.459 -6767.209	HARRIS WELL SWG-SEE ELEV.SHT.  5913.490 FINCH SPRING  5897.720  CULVERT KELLY/GOLDER  5907.220  KELLY SPRING 2  5907.780  BOYSCOUT SPRING  5969.220  FISH POND ABOVE LEDGE SPRINGS  5917.380  SPRG. HOUSE 5 WATER ELEV.  5917.380  SPRING HOUSE 5 WATER ELEV.  5911.080  SPRING HOUSE 4 WATER ELEV.  5914.290  SPRING HOUSE 3 WATER ELEV.  5905.280  SPRING HOUSE 2 WATER ELEV.  5903.680
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	2010 000	10000	MORMON SPRING A OVER FLOW
80	6218.932	-13079.408	5843.550
			MORMON SPRING B
81	6059.070	-13433.087	5834.010
		•	MORMON SPRING C
82	7376.649	-13951.288	5855.460
			N END CULVERT SW SPRING
83	4116.624	-13712.467	5815.860
			HOMESTEAD SPRING
84	4397.257	-11013.312	5864.350 LEWIS WELL
85	14758.562	1321.514	100.023
			CONC. SPRING BOX
86	13534.431	-1352.990	6123.880
			FORMATION POND A
87	13905.784	-1415.936	6124.840
•			FORMATION POND B
88	14003.753	-1508.564	6126.410 HEADGATE C
89	14096.681	-1788.955	6122.420
			FORMATION POND D
90	14355.891	-1860.838	6119.890
			FORMATION POND E
91	14768.346	1112.406	6149.260
			FORMATION SPRING
92	12091.948	-2525.839	6068.750
			POND S OF RD.
93	13873.914	-11197.747	
		· = = - · · · • ·	WELL 2 SULFURIC

PIPE

A. A. HUDSON

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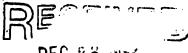
#### **ASSOCIATES**



14166 CLEVELAND RD. PRESTON, IDAHO 83263 (208) 427-6214

180 EAST 2nd SOUTH **SODA SPRINGS IDAHO 83276** (208) 547-4141

December 22, 1992



DEC 28 ಚಿತ್ರಕ

Golder .....es

David Banton Golder Associates 4104 148th Avenue, NE Redmond, WA 98052

Dear David,

Enclosed are the Monsanto and state plane coordinates for the surveying we completed at Monsanto. Also enclosed is our invoice covering the remainder of the work done. Thank you for giving us an opportunity to work with you.

Sincerely,

Alex A. Hudson, PLS, PE

AAH/bjp Enclosure

## A. A. HUDSON

913-1101.605

#### and

#### **ASSOCIATES**



14166 CLEVELAND RD. PRESTON, IDAHO 83263 (208) 427-6214 180 EAST 2nd SOUTH SODA SPRINGS IDAHO 83276 (208) 547-4141

		Monsanto Co	ordinates	Top of co	enem or	C	aus
Points	Northing	Easting	M.P.	Ground	Description	on Ground	
1	7352.5011	-10127.3436			EM-1 0+00	5,775	
2	6408.1214	-10134.4565			EM-2 0+00		
3	5052.1078	-10140.1506			EM-3 0+00		
1	4801.8924	-10146.5542			EM-4 0+00		
5	7440.4467	-14727.9342			EM-1 46+00		
6	6496.0671	-14735.0470			EM-2 16+00		
7	5726.6703	-14040.6513			EM-3 39+00		
8	4876.4550	-14047.0549			EM-4 39+00		
9	6348.2578	-10598.5356	5910.00	5908.40	Well TW-56	5907.70	
10	€427.1402	-11133.9247	5886.33	5884.64	Well TW-55	5884.33	
11	6436.4812	-11633.2207	5888.96	5887.79	Well TW-54	5886.70	
12	6446.5431	-12133.9750	5880.39	5879.56	Well TW-53	5878.35	
13	7361.3130	-11402.1415	5892.74	5890.32	Well TW-58	5889.84	
14	12769.1758	-12782.8805	5952.54	5950.38	Well TW-57	5950.36	

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STATE	פותוע	( AArd	linates

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			1.	isp of Cemen	4	Corrected	6
Points	Northing	Easting	M.P.	Charles	Description	n Ground	
1	368989.7057	656732.5993		E	M-1 0+00	_,	
2	368045.6152	656739.0828		E	M-2 0+00		
3	367289.8330	656744.2731		E	M-3 0+00		
4	366439.8780	656750.1101		E	M-4 0+00		
5	369011.3940	652132.6505		E	M-1 46+00		
6	368067.3035	652139.1340			M-2 46+00		
7	367308.2209	652844.3165		E	M-3 39+00		
8	366458.2659	652850.1535			M-4 39+00		
9	367979.0964	656276.0578	5910.00	5908.40 W	ell TW-56	5907.70	
10	368050.2397	655739.7553	5886.33	5884.64 W	ell TW-55	5884.33	
11	368052.3900	655240.5318	5888.96	5887.79 W		5986.70	
12	368055.2399	654739.8404	5880.39	5879.56 W		5678,35	
13	368980.1644	655458.2033	5892.74	5890.32 W	· ·	5889-84	
14	374365.9107	654000.1960	5952.54	5950.38 W		5950,36	-
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DEC 22 1992

913-1101.605

### A. A. HUDSON

and **ASSOCIATES** 



14166 CLEVELAND RD. PRESTON, IDAHO 83263 (208) 427-6214

180 EAST 2nd SODA SPRINGS IDAHO 83276 (208) 547-4141 _____ ASELGIALES

26 February 1993

David Banton Golder Associates 4104 148th Avenue NE Redmond, WA 98052

Dear Mr. Banton,

On February 25 we checked the elevation of the M.P. on the TW-36 at Monsanto. The elevation we obtained was 5906.93. We used the M.P. of TW-20 as a bench mark. The difference between today's reading and our original reading of 5906.81 may be due to the fact that the measuring point plate is loose. The top of concrete elevation is 5904.51 which corresponds well with our 1991 reading.

I have included an invoice. The longer time was necessary because we had to locate TW-36 with our instruments since it was well under the top of the snow.

Should you have any questions, please call.

Sincerely yours,

Alex Hudson, PLS, PE

AAH/bjp Enclosure 92171

## APPENDIX H-4 MONITORING WELL INSTALLATION

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2.	DRILLING AND INSTALLATION OF MONITORING WELLS	2
	<ul><li>2.1 Drilling, Soil Sampling, and Well Completion</li><li>2.2 Geophysical Logging</li><li>2.3 Well Development</li></ul>	2 6 6
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#### LIST OF FIGURES

H-1. Location of Wells and Springs in the Upper Basalt Zone

#### **LIST OF ATTACHMENTS**

ATTACHMENT H-1 Lithology and Well Completion Logs for New Wells
ATTACHMENT H-2 Geophysical Borehole Logs for New Wells

ATTACHMENT H-3 Geodetic Survey Information for New Wells and Electromagnetic Survey
Transect Coordinates

#### 1. INTRODUCTION

This appendix describes the drilling and installation of five monitoring wells and one test well at the Monsanto Plant in Soda Springs, Idaho, completed as part of the remedial investigation and feasibility study (RI/FS) as described in the Phase II Remedial Investigation Work Plan (Golder 1992a). The drilling and installation activities took place in the fall and winter of 1992. All drilling activities were performed by Andrew Well Drilling under the observation of a Golder hydrogeologist. Prior to drilling, permits for well construction were obtained from the State of Idaho Water Resources Department.

The new wells were designated test well 53 through 58 (TW-53 through TW-58). TW-53 through TW-57 were drilled for monitoring purposes and TW-58 was drilled for aquifer testing purposes. Wells TW-53 through TW-56 and TW-58 are located along the southern Plant fenceline: TW-53 is located west of the Subsidiary Fault in the UBZ-1 region; TW-54, TW-55, and TW-58 are located between the Subsidiary Fault and the Monsanto Fault in the UBZ-2 region; and TW-56 is located east of the Monsanto Fault in the UBZ-3 region. TW-57 is located upgradient of the old underflow solids ponds in the UBZ-2 region and will provide water quality control data. The new wells were geodetically surveyed after completion.

#### 2. DRILLING AND INSTALLATION OF MONITORING WELLS

The downgradient monitoring wells (TW-53 through TW-56) were installed in order to: 1) confirm the geophysical interpretation regarding plume extent; 2) to evaluate the downgradient groundwater quality; and 3) further characterize the Subsidiary Fault and the Monsanto Fault which underlie the Plant and which separate the UBZ-1, UBZ-2, and UBZ-3 flow regions. The upgradient monitoring well (TW-57) was installed to assess the background groundwater quality in the UBZ-2 region.

#### 2.1 Drilling, Soil Sampling, and Well Completion

A decontamination area was established at the Plant to be used for steam cleaning the drill rig and drilling equipment prior to drilling each well. The decontamination area was located on the berm between the two sewage evaporation ponds in the southwest corner of the Plant.

All wells were drilled using air-rotary drilling methods. Water, obtained from Monsanto's potable water supply, was occasionally added to the boreholes to minimize dust. Soil and/or rock cuttings were collected and logged every five feet during drilling activities.

The monitoring wells were completed with 4-inch diameter, box threaded, Schedule 40 PVC casing and well screens (0.02-inch slotted). The filter-packs consist of Colorado 10/20 silica sand and the annular seals consist of approximately three feet of bentonite pellets, hydrated with Monsanto potable water, overlain by a cement-bentonite grout to ground surface. The filter-packs and annular seals were installed using a tremie pipe.

A detailed discussion of drilling, borehole lithology, and well construction activities are given below for each new monitoring well. Borehole logs for the new wells are provided in Attachment H-1 and well-construction details are summarized in Table H-1.

#### TW-53:

Well TW-53 was drilled from October 15 to October 17, 1992 and was installed from October 29 to October 30, 1992. The borehole was initially drilled using an 8-inch tri-cone bit through silty fine sands and broken basalt fragments to a depth of 15 feet below ground surface (bgs) at which point dark gray basalt was encountered. The borehole was then reamed using a 10-inch tri-cone bit in order to install 8-inch steel surface casing to stabilize the hole. After the surface casing was installed, 8-inch open-hole drilling was continued to a total depth of 62 feet bgs.

Groundwater was encountered at a depth of approximately 22 feet bgs in a zone of weathered, vesicular, broken basalt ( $^{-}5$  gallons per minute (gpm)) and at a depth of 53 feet bgs in a cinder zone ( $^{-}2$  gpm). The well screen was set in the upper water-bearing zone at 22 feet bgs because more water was produced from this zone and because TW-10 (located approximately 1,000 feet northwest of TW-53 in the same flow region) was screened at a similar depth and has had detectable constituent concentrations in the past (Golder 1992b). Specific conductance of the groundwater immediately before discontinuing drilling was 670  $\mu$ S/cm. Static-water level immediately after drilling to total depth was 21.2 feet bgs.

TW-53 was completed by installing cement/bentonite grout up to 37 feet bgs and bentonite chips up to 32 feet bgs. A 10-foot screen, equipped with a bottom cap, was set from 20.2 to 30.2 feet bgs. Attached to the screen was 22 feet of casing, set from 2.0 feet above ground surface (ags) to 20.2 feet bgs. The filter-pack was installed from 17.7 feet to 32.0 feet bgs and the annular seal was installed from 0 to 17.7 feet bgs. Two stainless-steel centralizers were placed on the well at 30.5 feet bgs and at 19.5 feet bgs.

The steel surface-casing was pulled out of the hole approximately four feet and cut off to form a protective monument around the PVC well casing. The steel surface-casing is set from 2.9 feet ags to 15 feet bgs. A 1/4-inch diameter hole was drilled into the protective monument directly above grout level to permit water to drain out and coarse sand was placed above the grout. The well is equipped with a locking cap and a domed concrete pad is constructed around the base of the protective monument.

#### TW-54:

Well TW-54 was drilled on October 22, 1992 and was installed on October 29, 1992. The borehole was initially drilled using an 8-inch tri-cone bit through clayey silts, broken basalt, and cinders to a depth of 25 feet bgs at which point dark gray basalt was encountered. The borehole was then reamed using a 10-inch tri-cone bit in order to install 8-inch steel surface casing to stabilize the hole. After the surface casing was installed, 8-inch open-hole drilling was continued to a total depth of 76.3 feet bgs.

Groundwater was encountered at approximately 44 feet bgs (~5 gpm) in a fractured basalt and cinder zone. Drilling was continued in order to locate a higher water-producing zone. A higher producing zone, however, was not encountered. The specific conductance of the groundwater during drilling was 1,970 S/cm. Static-water level approximately 12 hours after the borehole was drilled was 29.3 feet bgs.

The well was completed by installing cement/bentonite grout up to 56.7 feet bgs and bentonite chips up to 52.0 feet bgs. A 10-foot screen, equipped with a bottom cap, was set from 39.5 to 49.5 feet bgs. Attached to the screen was 42 feet of PVC casing, set from 2.3 feet ags to 39.5 feet bgs.

The filter-pack was installed from 37.0 feet to 52.0 feet bgs and the annular seal was installed from 0 to 37.0 feet bgs. Three stainless-steel centralizers were placed on the well at 50.0 feet, 39.0 feet, and 27.0 feet bgs.

The steel surface-casing was pulled out of the hole approximately two feet and cut off to form a protective monument around the PVC well casing. The steel surface-casing is set from 3.0 feet ags to 23.0 feet bgs. A 1/4-inch diameter hole was drilled into the protective monument directly above grout level to permit water to drain out and coarse sand was placed above the grout. The well is equipped with a locking cap and a domed concrete pad is constructed around the base of the protective monument.

#### TW-55:

Well TW-55 was drilled from October 19 to October 20, 1992 and was installed from October 20 to October 21, 1992. The borehole was initially drilled using an 8-inch tri-cone bit through silty clays, clayey silts, and broken basalt to a depth of 20 feet bgs at which point dark gray basalt was encountered. The borehole was then reamed using a 10-inch tri-cone bit in order to install 8-inch steel surface casing to stabilize the hole. After the surface casing was installed, 8-inch open-hole drilling was continued to a total depth of 69 feet bgs.

Groundwater was encountered in a small fracture at approximately 34 feet bgs (~0.5 gpm), in a fracture zone at 47 feet bgs (~5 gpm), and in a cinder zone at 58 feet bgs (~10 gpm). The specific conductance of the groundwater during drilling ranged from 1,786 S/cm to 1,880 S/cm. Staticwater level approximately 12 hours after the borehole was drilled was 29.5 feet bgs.

The well was completed by installing bentonite pellets up to 66.7 feet bgs. A 10-foot screen, equipped with a bottom cap, was set from 55.0 to 65.0 feet bgs. Attached to the screen was 57 feet of casing, set from 2.0 feet ags to 55.0 feet bgs. The filter-pack was installed from 51.8 feet to 66.7 feet bgs and the annular seal was installed from 0 to 51.8 feet bgs. Two stainless-steel centralizers were placed on the well at 65.5 feet bgs and at 54.0 feet bgs.

The steel surface-casing was pulled out of the hole approximately one and a half feet and cut off to form a protective monument around the PVC well casing. The steel surface-casing is set from 2.9 feet ags to 17.5 feet bgs. A 1/4-inch diameter hole was drilled into the protective monument directly above grout level to permit water to drain out and coarse sand was placed above the grout. The well is equipped with a locking cap and a domed concrete pad is constructed around the base of the protective monument.

#### TW-56:

Well TW-56 was drilled from October 24 to October 27, 1992 and was installed from October 27 to October 28, 1992. The borehole was initially drilled using an 8-inch tri-cone bit through clayey silts, broken basalt, and cinders to a depth of 22 feet bgs at which point dark gray basalt was encountered. The borehole was then reamed using a 10-inch tri-cone bit in order to install 8-inch steel surface casing to stabilize the hole. After the surface casing was installed, 8-inch open-hole drilling was continued to a total depth of 106 feet bgs.

Groundwater was encountered at approximately 90 feet bgs (5 gpm). The specific conductance of the groundwater during drilling was 1,400 S/cm. Static-water level approximately 12 hours

after drilling to total depth was 59.6 feet bgs.

The well was completed by installing bentonite chips from 98 to 106 feet bgs. A 10-foot screen, equipped with a bottom cap, was set from 85.7 to 95.7 feet bgs. Attached to the screen was 88 feet of casing, set from 2.3 feet ags to 85.7 feet bgs. The filter-pack was installed from 84.5 feet to 98.0 feet bgs and the annular seal was installed from 0 to 84.5 feet bgs. Four stainless-steel centralizers were placed on the well at 96.2 feet, 85.8 feet, 65.0 feet, and 45.0 feet bgs.

The steel surface-casing was pulled out of the hole approximately two feet and cut off to form a protective monument around the PVC well casing. The steel surface-casing is set from 3.2 feet ags to 20 feet bgs. A 1/4-inch diameter hole was drilled into the protective monument directly above grout level to permit water to drain out and coarse sand was placed above the grout. The well is equipped with a locking cap and a domed concrete pad is constructed around the base of the protective monument.

#### TW-57:

Well TW-57 was drilled from October 14 to October 15, 1992 and was installed from October 23 to October 24, 1992. The borehole was initially drilled using an 8-inch tri-cone bit through clayey silts and broken basalt to a depth of 8 feet bgs at which point dark gray basalt was encountered. The borehole was then reamed using a 10-inch tri-cone bit in order to install 8-inch steel surface casing to stabilize the hole. After the surface casing was installed, 8-inch open-hole drilling was continued to a total depth of 35.1 feet bgs.

The uppermost water-bearing zone was encountered at approximately 28 to 30 feet bgs (5 gpm). The specific conductance of the groundwater was 1,840 S/cm. Static-water level immediately after drilling to total depth was 11.5 feet bgs.

A 10-foot screen, equipped with a bottom cap, was set from 24.6 to 34.6 feet bgs. Attached to the screen was 27 feet of casing, set from 2.2 feet ags to 24.6 feet bgs. The filter-pack was installed from 21.0 feet to 35.1 feet bgs and the annular seal was installed from 0 to 21.0 feet bgs. Two stainless-steel centralizers were placed on the well at 35.0 feet and 23.5 feet bgs.

The steel surface-casing was pulled out of the hole approximately three feet and cut off to form a protective monument around the PVC well casing. The steel surface-casing is set from 3 feet ags to 5 feet bgs. A 1/4-inch diameter hole was drilled into the protective monument directly above grout level to permit water to drain out and coarse sand was placed above the grout. The well is equipped with a locking cap and a domed concrete pad is constructed around the base of the protective monument.

#### 2.2 Geophysical Logging

After reaching total depth and prior to the installation of the wells, the boreholes were geophysically logged using resistivity, natural gamma, and spontaneous potential tools by a Monsanto representative. Wells TW-53 through TW-56 were additionally logged after well installation using natural gamma and induction tools. Geophysical logs for TW-53 through TW-57 are provided in Attachment H-2.

The purpose of geophysical borehole logging was to substantiate lithologic interpretations and

to aid in stratigraphic correlation between wells. Natural gamma provides information on the lithology and stratigraphy and is the most useful log for correlations in basaltic environments (Crosby and Anderson 1971) due to high natural gamma activity in clayey interflow zones. Resistivity and spontaneous potential also provide lithologic information.

#### 2.3 Well Development

Each monitoring well was developed for approximately 30 minutes after well installation. Wells were developed using a submersible pump and pumping at an appropriate rate to keep the water levels in the wells above the top of the well screens. During development, wells were intermittently surged by raising and lowering the pump. The color of the groundwater in the wells was initially brownish-red but became clear within five minutes. Specific conductance of the groundwater was measured throughout development.

TW-53 was developed for 30 minutes on November 6, 1992. The well was pumped at a rate of approximately 6.5 gpm. Approximately 195 gallons of water were purged and the water-level drew down 0.6 feet. Specific conductance remained relatively constant at about 1,100 S/cm.

TW-54 was developed for 33 minutes on November 6, 1992. The well was pumped at a rate of approximately 2.5 gpm. Approximately 83 gallons of water were purged and the water-level drew down 2.5 feet. Specific conductance remained relatively constant at about 2,100 S/cm.

TW-55 was developed for 32 minutes on November 6, 1992. The well was pumped at a rate of approximately 20 gpm. Approximately 640 gallons of water were purged and the water-level drew down 11.5 feet. Specific conductance remained relatively constant at about 2,000 S/cm.

TW-56 was developed for about 2 hours on November 5, 1992. The well was pumped at a rate of approximately 0.8 gpm. Approximately 96 gallons of water was purged and the water-level drew down 34 feet. Specific conductance was 1,310 S/cm after 110 minutes of pumping.

TW-57 was developed for 24 minutes on November 7, 1992. The well was pumped at a rate of approximately 27 gpm. Approximately 648 gallons of water was purged and the water-level drew down 6.1 feet. Specific conductance ranged from 1,360 S/cm to 1,600 S/cm during development.

#### 3. DRILLING AND INSTALLATION OF AN AQUIFER TEST WELL

Well TW-58 was installed to conduct a pumping test in order to further characterize the aquifer in the southern UBZ-2 region. TW-58 was drilled from November 2 to November 4, 1992 and was installed from November 5 to November 6, 1992. The borehole was initially drilled using a 16-inch tri-cone bit through clayey silt and basalt fragments to a depth of 16 feet bgs at which point dark gray basalt was encountered. After 12-inch surface casing was installed to stabilize the borehole, open-hole drilling was continued using a 12-inch tri-cone bit to a total depth of 55 feet bgs.

Groundwater was encountered at 40 feet bgs (~5 gpm) and at 47 feet bgs (~100 to 200 gpm). Specific conductance of the groundwater from 40 feet bgs and 47 feet bgs was 1,460 and 1,710 S/cm, respectively. Static-water level immediately after drilling to total depth was 28.8 feet bgs.

The total depth of the hole was 55 feet bgs, however, the borehole caved-in to 51.7 feet bgs. The well was completed with a 10-foot, 0.10-inch wire-wrapped, 8-inch diameter, stainless-steel screen set from 40.7 to 50.7 feet bgs with a one-foot tail-pipe. Welded to the screen is 44 feet of black steel casing, set from 2.9 feet ags to 40.7 feet bgs. A filter-pack of washed pea-gravel was installed from 36.3 to 51.7 feet bgs. The annular seal consisted of 4.4 feet of bentonite pellets, set from 31.9 to 36.3 feet bgs and hydrated with Monsanto potable water, overlain with cement/bentonite grout to ground surface.

The 12-inch steel surface-casing was pulled completely out of the hole and the 8-inch steel well casing was cut off 2.9 feet ags. The well is equipped with a locking cap and a domed concrete pad is constructed around the base of the well.

#### 4. GEODETIC SURVEY

Each of the new wells were geodetically surveyed by a licensed surveyor (A. A. Hudson and Associated of Soda Springs) for both horizontal location (Monsanto Plant coordinates and Idaho State Plane Coordinates) and elevation. Elevations are specified as feet above mean sea level (msl), and are accurate to within 0.01 feet; coordinates are accurate to within 0.001 feet. Survey information for the new wells is provided in Attachment H-3.

#### 5. REFERENCES

Crosby, J.W. III and J.V. Anderson, 1971, "Some Applications of Geophysical Well Logging to Basalt Hydrogeology", *Ground Water*, pp. 12-20.

Golder Associates Inc., 1992a, Phase II Remedial Investigation Work Plan for the Soda Springs Elemental Phosphorus Plant, Revision 1, Golder Associates Inc., Redmond, Washington.

Golder Associates Inc., 1992b, Phase I Remedial Investigation/Feasibility Study Preliminary Site Characterization Summary Report for the Soda Springs Elemental Phosphorus Plant, Volumes 1 and 2, Golder Associates Inc., Redmond, Washington.

**TABLES** 

#### TABLE H-1

## WELL CONSTRUCTION DETAILS FOR NEW WELLS

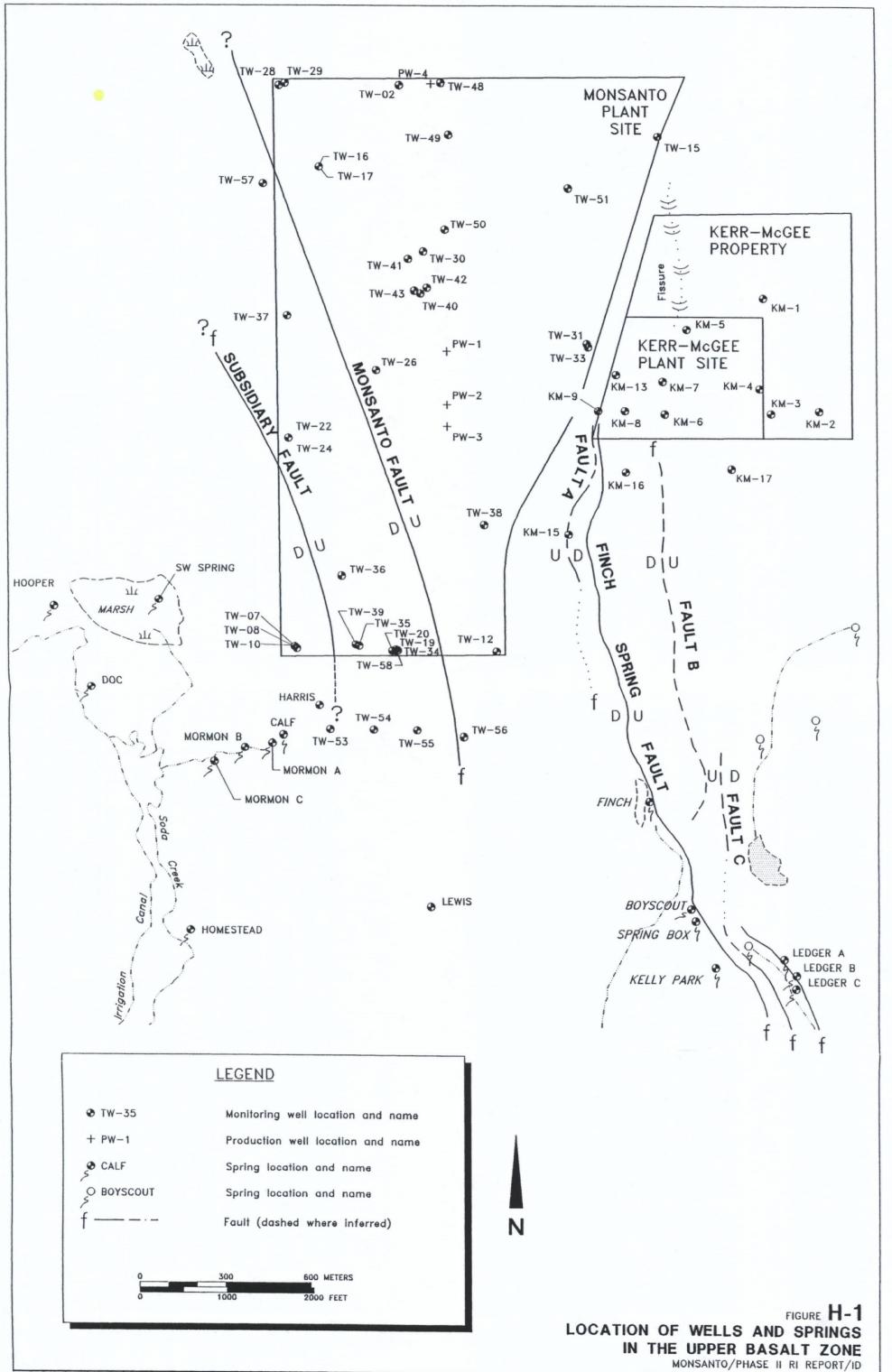
WELL			ORDINATES CONSTRUCTION ELEVATION		HOLE DIAMETER	CASING DIAMETER	HOLE DEPTH	CASING DEPTH	CASING MATERIAL	MONITORED INTERVAL	FORMATION MONITORED
	Northing	Easting	DATE	(ft amsl)	(in)	(in)	(ft bgs)	(ft bgs)		(ft bgs)	
TW-53	368055.24	654739.84	10/30/92	5,878.35	8.0	4.0	61.8	30.5	PVC	17.7 - 32.0	UBZ
TW-54	368052.39	655240.53	10/29/92	5,886.70	8.0	4.0	76.3	50.0	PVC	37.0 - 52.0	UBZ
TW-55	368050.24	655739.76	10/21/92	5,884.33	8.0	4.0	69.0	65.5	PVC	51.8 - 66.7	UBZ
TW-56	367979.10	656276.06	10/28/92	5,907.70	8.0	4.0	106.0	96.2	PVC	84.5 - 98.0	UBZ
TW-57	374365.91	654000.20	10/24/92	5,950.36	8.0	4.0	35.1	35.1	PVC	21.0 - 35.1	UBZ
TW-58	368980.16	655458.20	11/03/92	5,889.84	12.0	8.0	55.0	51.7	STEEL	36.3 - 51.7	UBZ

#### NOTES:

bgs - below ground surface

amsi - above mean sea level UBZ - Upper Basalt Zone

#### **FIGURES**



# ATTACHMENT H-1 LITHOLOGY AND WELL COMPLETION LOGS FOR NEW WELLS

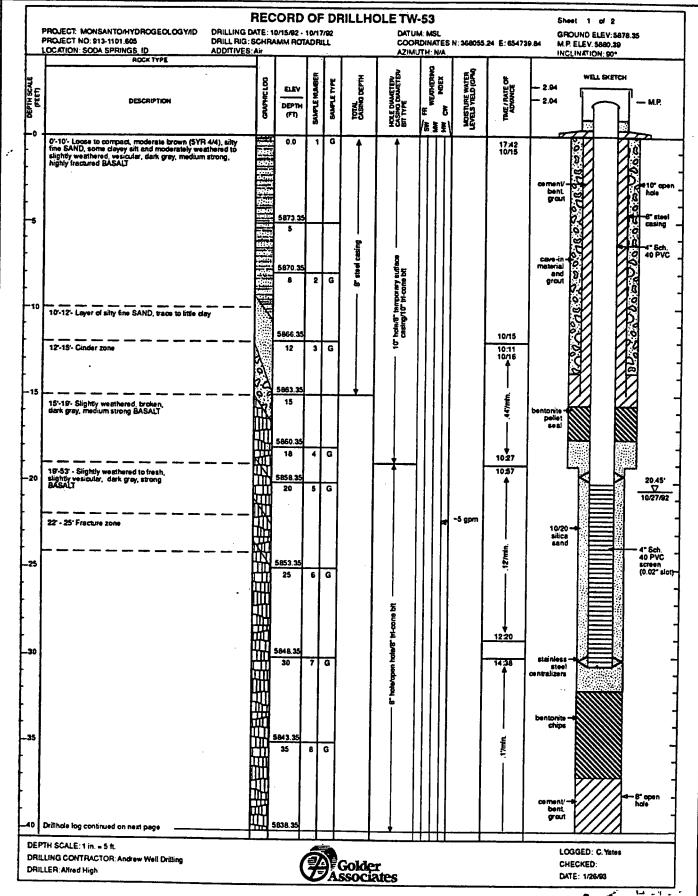


FIGURE A-1 (Sheet 1 of 2)

LITHOLOGY AND WELL COMPLETION - TW-53

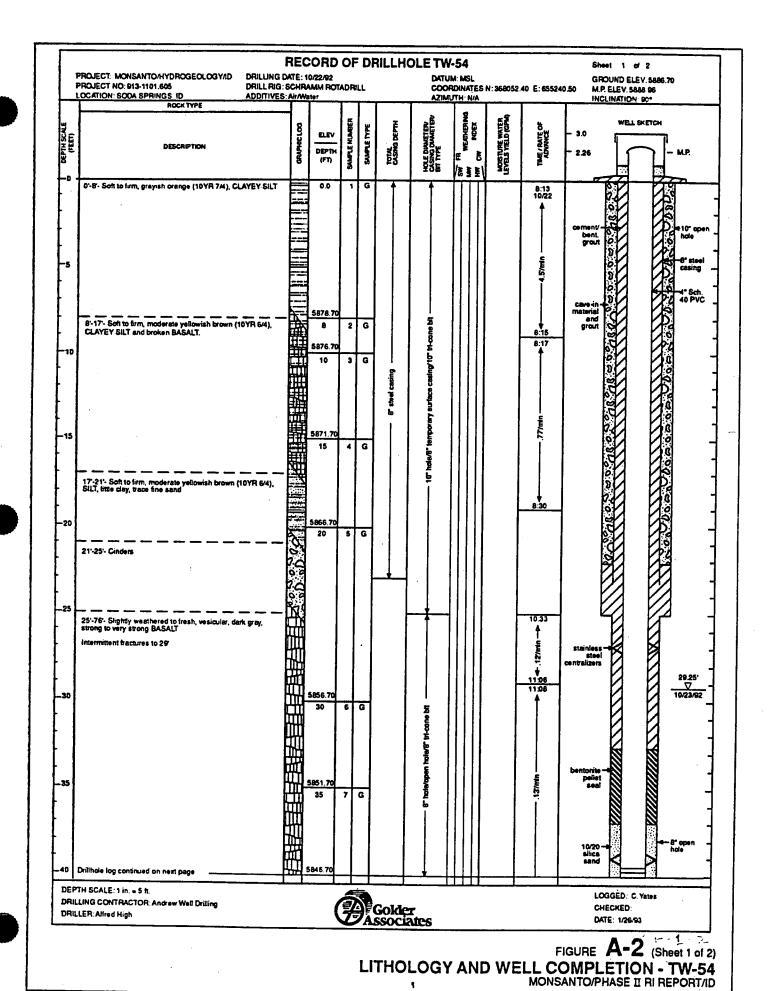
MONSANTO/PHASE II RI REPORT/ID

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	PROJECT: MONSANTO/HYDROGEOLOGY/ID PROJECT NO: 913-1101.605 LOCATION: SODA SPRINGS, ID ROCK TYPE	DRILLING DATE DRILL RIG: SO ADDITIVES: A	TE: 10. CHRAI	/15/92 -	10/17/	92		COO	IM: MSL RDINATES UTH: N/A	S N: 368055	.24 E: 65473	Sheet 2 of 2 GROUND ELEV: 5878.35 9.84 M.P. ELEV: 5880.39 INCLINATION: 90°
DEPTH SCALE (FEET)	DESCRIPTION		GRAPHICLOS	ELEV DEPTH (FT) 5838.35	SAMPLE NIMBER	SAMPLE TYPE	TOTAL CASING DEPTH	HOLE DAWETERV CASHO DAMETERV VASTEMU	SW FR WEATHERING HW WDEX		TAKE / RATE OF ADVANCE	WELL EXETCH
	19-53- Slightly weathered to fresh, dark gray, st	Į.		40	•	G						cement/—bent.
45				5833.35 45	10	G		H-cone bit			10/16 17:52	
-50 - -	53'-55'- Cinder zone			5828.35 50	11	G		8" hole/open hole/6" tri-cone bit		~2 gpm	7:49 10/17	
-55	95'-51.75'- Moderately weathered to slightly weathered, fractured and broken, dark grey, medium strong BASALT	— — — S		823.35 55	12	G					. 26/min. —	
-60	BOH = 61.75' below ground surface		-     5	818.35 60 816.60 61.75						С=670 µS/cm	10/17 8:43	61.75
-65												
-70												
-75												
. <b>8</b> 0												
DRIL	TH SCALE: 1 in. = 5 ft. LING CONTRACTOR: Andrew Well Drilling LER: Alfred High			1	T.		Golde: socia					LOGGED: C. Yates CHECKED:

FIGURE A-1 (Sheet 2 of 2)
LITHOLOGY AND WELL COMPLETION - TW-53
MONSANTO/PHASE II RI REPORT/ID

136 W - 2 44



PROJECT NO. 913-1101.608 DRAWING NO. 47313 DATE 3/10/93 DRAWN BY TK

MOUNT #

**Golder Associates** 

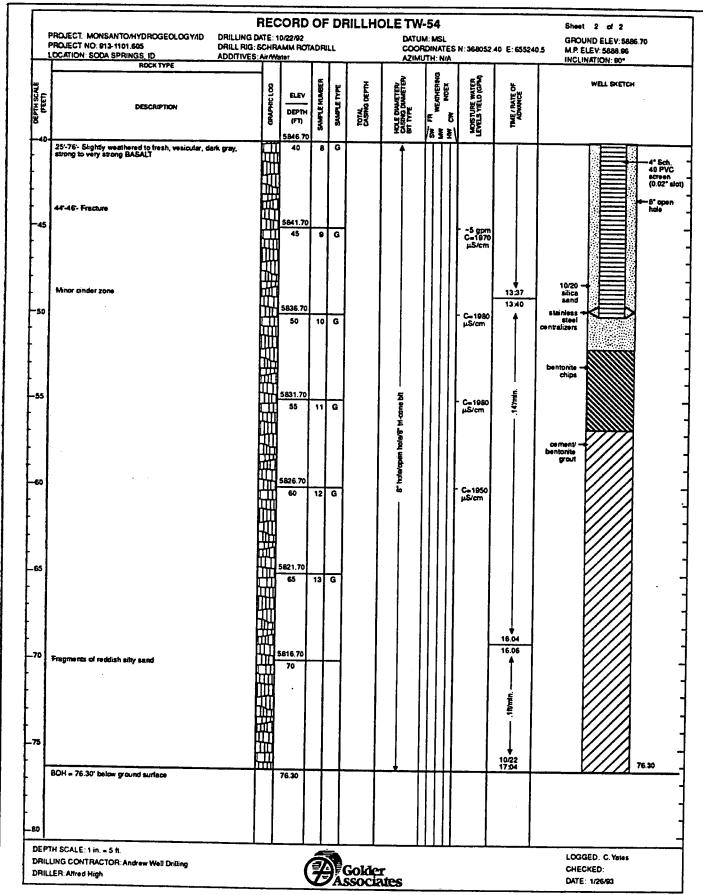


FIGURE A-2 (Sheet 2 of 2)
LITHOLOGY AND WELL COMPLETION - TW-54
MONSANTO/PHASE II RI REPORT/ID

l	PROJECT NO: 913-1101.605 DRILL F LOCATION: SODA SPRINGS, ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITIONAL SPRINGS ID ADDITI	IG DATE: 1 IG: SCHR	0/19/92 -	10/20	V92	***************************************	COO	M: MSL	N:368050	.20 E: 65573	9.80 M.P. ELI	ID ELEV: 5884.33 EV: 5886.33 RTION: 90°
DEPTH SCALE (FEET)	ROCK TYPE  DESCRIPTION	GRAPHICLOG	DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	TOTAL CASING DEPTIN	HOLE DIAMETER CASING DIAMETER BIT TYPE	SW FR WEATHERNO HW CW NDEX	MOISTURE WATER LEVELS YELD (GPM)	TIME / RATE OF ADVANCE		WELL SKETCH — M.P.
	0'-4'- Very loose to loose, moderate reddsh brown (10R 4/6), SILTY CLAY		0.0	1	G	1	1			10/19	0:0	
5	4'-10'- Loose, pale brown (SYR 5/2) CLAYEY SILT		5877.33 7	2	G	if cesting					cave-in-material	000 20 20 00 00 00 00 00 00 00 00 00 00
- - -10			5874.33			- Grathed	10" hole/8" temporery surface casing/10" tri-cone bit				grout O	8 steel 8 casing
.	10-19- Cinders, broken basalt and boulders, title to some clayey silt		10	3	G		10" hote/8" surface ca tri-cort			1622	D 0.0	
-15										.73/atn.	30 1000	Section 1
-20	19-22- Fractured BASALT		5866.83 17.50 5864.33 20	4	G	<b>.</b>				16:33		
	22-44- Slightly weathered to fresh, vesicular, dark gray, strong BASALT	- 語								<u>e</u>		
-25			5859.33 25	5	<u>.</u>					.14/min.		i str
-30	Grades to tresh		5854.33				6" hole/open hole/ 8" tri-cone bit			10/19 18×10 7:40		29.46 \(\nabla\)
		푪	30	6	G		p			10/20		10/21/92
35	24'-35' Fracture		3849.33 35	7 (	G				-0.5gpm С=1786 µS/cm			
4D	Drillhole log continued on next page		B44.33						C=1860 μS/cm	. 127min. –	cement/—bent.	4-8" open hole -
	TH SCALE: 1 in. = 5 ft. LING CONTRACTOR: Andrew Well Drilling			<u></u>		Solde					LOGGE	D: C. Yates

FIGURE A-3 (Sheet 1 of 2)
LITHOLOGY AND WELL COMPLETION - TW-55
MONSANTO/PHASE II RI REPORT/ID

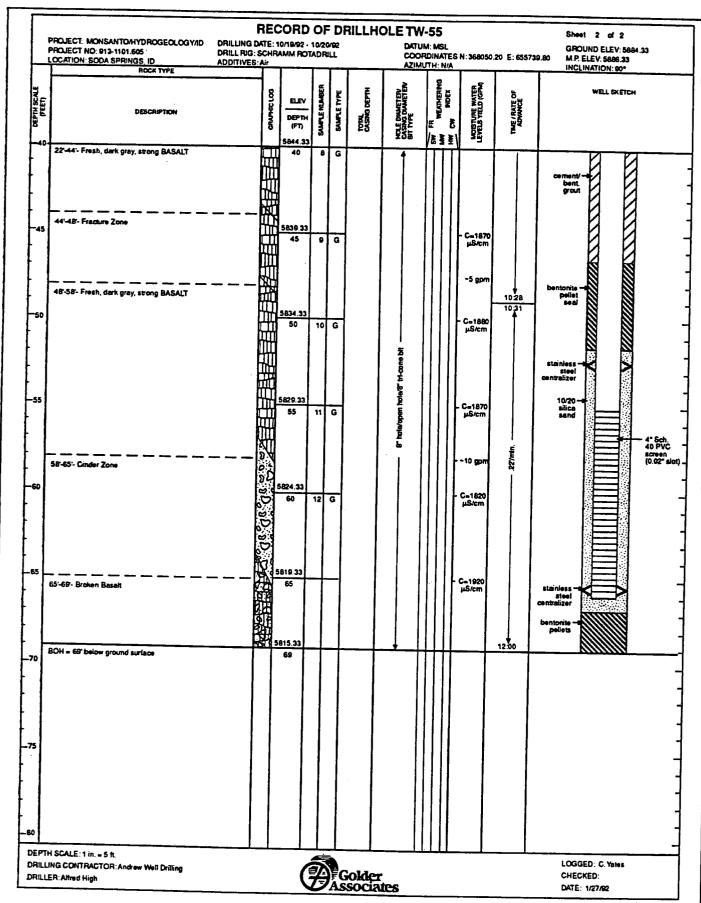


FIGURE A-3 (Sheet 2 of 2)
LITHOLOGY AND WELL COMPLETION - TW-55
MONSANTO/PHASE II RI REPORT/ID

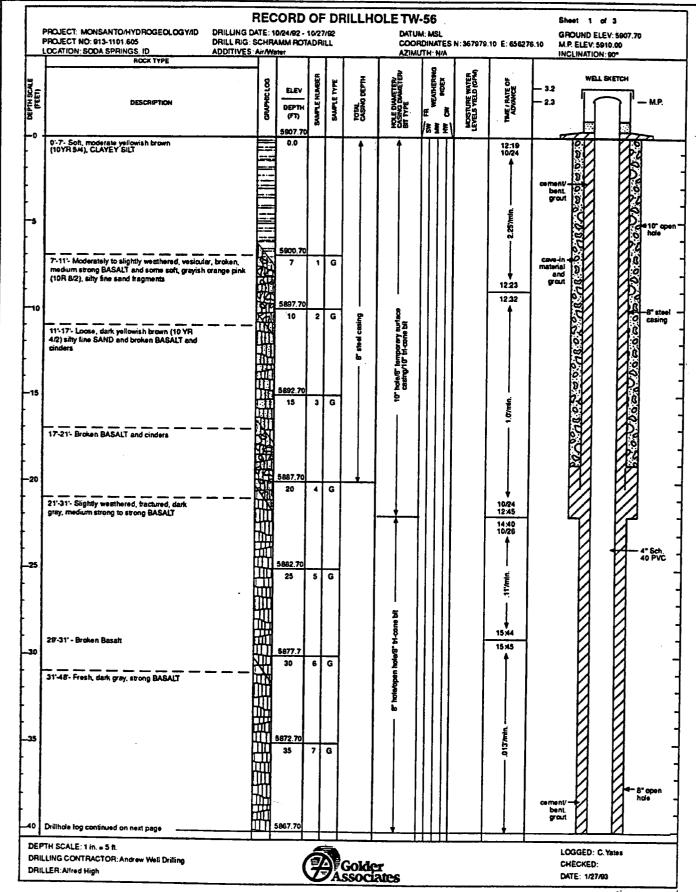


FIGURE A-4 (Sheet 1 of 3)

LITHOLOGY AND WELL COMPLETION - TW-56

MONSANTO/PHASE II RI REPORT/ID

DESCRIPTION  31'-48'- Fresh, dark gray, strong BASALT grades to strong to very strong  48'-57'- Broken BASALT, little cinders, little at moderate brown (SYR 3/4) sitt  50  57'-78'- Moderately weathered to fresh, broke gray, strong BASALT, little sitty fine sand  60  62'-65'- Manor cinders	of to irm.		SAMPLE A	O O O	TOTAL CASHA DEPTH	8' hole/open hole/of tri-cone bit	SW PKATHENG LW WEATHENG	F 55	107/42 7:42 7:55 7:56	coment/ - bent grout steinless steel centralizer	LL SKETCH
48-57- Broken BASALT, little cinders, little semoderate brown (SYR 3/4) silt  50  57-76- Moderately weathered to fresh, broke grey, strong BASALT, little stily fine sand  60  62-65- Manor cinders	of to firm.	5862.7 45 5857.7 50 5852.76	8	G		/apen hale/6" tri-cone bit			17:42 7:42 10:27 4 	bent grout	
48-57- Broken BASALT, tittle cinders, little somoderate brown (SYR 3/4) sitt  50  57-76- Moderately weathered to fresh, broke grey, strong BASALT, little sitty fine sand  60  62-65- Manor cinders		5857.77 50 50 50 50 50 50 50	8	G		open hale/8" tri-cone bit			17:42 7:42 10:27 4 	bent grout	
57-76- Moderately weathered to fresh, broke gray, strong BASALT, little sitty fine sand 60 62-65- Minor cinders	- In derk	50 2 3 4 5 5 8 5 8 5 8 5 7	9			dpen hale/8" trl-cone bit			7:56		
57-76- Moderately weathered to fresh, broke gray, strong BASALT, little sitty line sand  62-65- Manor cinders		11.		G		/apen hate	1111	1 :		. 171	
-60 62'-65'- Minor cinders						₽		1 .			
-65		5847.70				epr. %			.69/min.		4° Sch 40 PV0
		•• ••	11	G							10/27/9
70		65 65	12	G					8.25	steinless steel steel centralizer	N. C. C. C. C. C. C. C. C. C. C. C. C. C.
		5837.70							8:25	И	Ø
75		70 5832.70	13					·	.25/min.		8° open hole
78-83'- Broken BASALT, cinders, and tittle sitt  Drillhole log continued on next page		75 5827.70	14	G							
DEPTH SCALE: 1 in. = 5 ft. DRILLING CONTRACTOR: Andrew Well Drilling				I			ш			LOGGED: 0	

FIGURE A-4 (Sheet 2 of 3)
LITHOLOGY AND WELL COMPLETION - TW-56
MONSANTO/PHASE II RI REPORT/ID

**RECORD OF DRILLHOLE TW-56** Sheet 3 of 3 PROJECT: MONSANTO/HYDROGEOLOGY/ID DRILLING DATE: 10/24/92 - 10/27/92 DATUM: MSL COORDINATES N: 367979.10 E: 656276.10 AZIMUTH: N/A PROJECT NO: 913-1101.605 LOCATION: SOOA SPRINGS, ID GROUND ELEV: 5907.70 M.P. ELEV: 5910.00 DRILL RIG: SCHRAMM ROTADRILL ADDITIVES: Air Wate NCLINATION: 80° DEPTH SCALE (FLET) TOTAL CASDIO DEPTH MOISTURE WATER LEVELS YIELD (GPV TIME / RATE OF ADVANCE WELL SKETCH SAMPLE NUMBEI SAMPLE TYPE BLEV DESCRIPTION DEPTH 78'-83'- Broken BASALT, cinders, and little silt 83'-90'- Broken BASALT 5822.70 stainless steel centralizer 85 16 G B:50 tri-cone bit 5817.70 0.5 gpm C≃1400 µS/cm 90'-94'- Cinders G 4° 8ch. 40 PVC screen (0.02° slot) 94'-106'- Broken and fractured BASALT 5812.70 18 G 5807.70 100 771 ALIG 5801.70 chips 1030 BOH=106' below ground surface 106 DEPTH SCALE: 1 in. = 5 ft. LOGGED: C. Yates DRILLING CONTRACTOR: Andrew Well Drilling Golder Associates CHECKED: DRILLER: Alfred High DATE: 1/27/93

FIGURE A-4 (Sheet 3 of 3)
LITHOLOGY AND WELL COMPLETION - TW-56
MONSANTO/PHASE II RI REPORT/ID

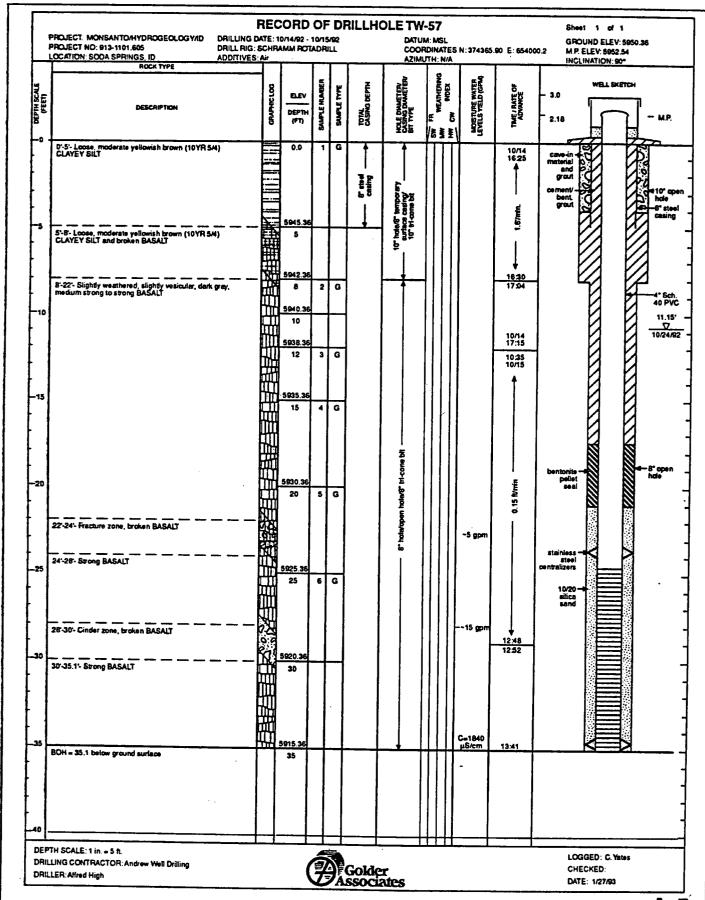


FIGURE A-5
LITHOLOGY AND WELL COMPLETION - TW-57
MONSANTO/PHASE II RI REPORT/ID

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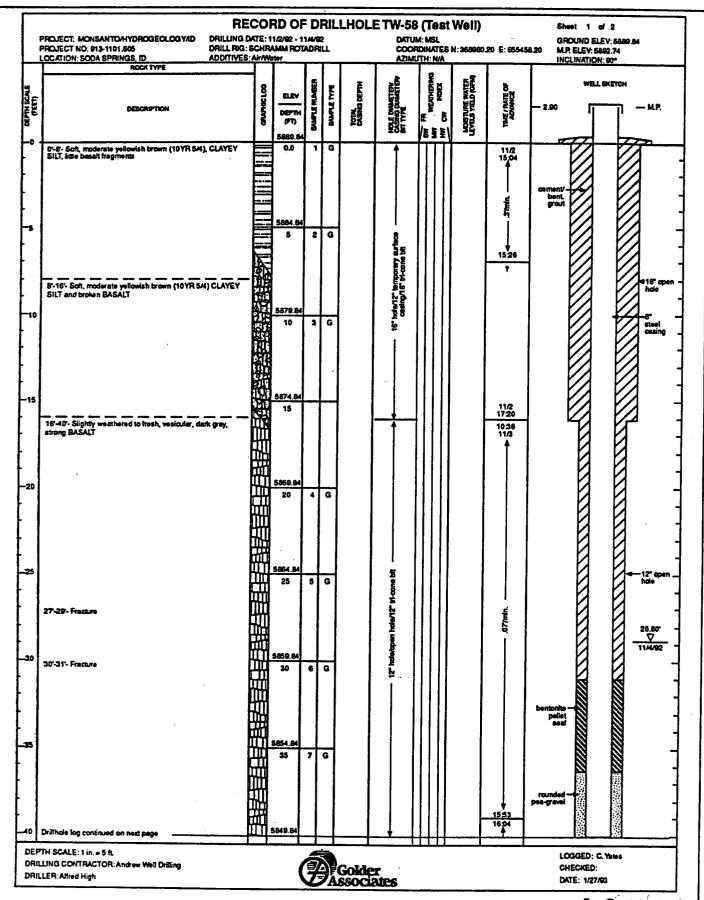


FIGURE A-6 (Sheet 1 of 2)
LITHOLOGY AND WELL COMPLETION - TW-58
MONSANTO/PHASE II RI REPORT/ID

47-47- 47-55- 50 BOH-5 (hole or	Broken BASALT  Cinders  Broken BASALT  S' below ground surface and myleted)	 CHELLE TOUCHERON	ĺ	6 SANTE MARKET	BALLETANNS G	HILDON CONTROL OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE 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contract water water to the contract water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water water w	11/2 17/2 OF 11/4	rounded pea-gravel B* steel casing		8" stain steel screen (0.1" si
47-47- 45 47-55- 50 BOH-5 (hole or was con	Cinders  Braken BASALT  5' below ground surface aved in to \$1.7' below ground surface aved in to \$1.7' below ground surface aved in to \$1.7' below ground surface aved in to \$1.7' below ground surface average avenue.		5845.84 44 5839.84 50				** ***********************************			- C=1460 μ3/cm - 100 gpm C=1710 μ3/cm - C=2070 μ3/cm	11/2 17/30 7/50 11/4	pea-gravel		steel screen (0.1° si
47-55- 50 BOH=5 (hole or was con	5' below ground surface aved in to 51.7' below ground surface a		5839.84 50 5834.84	9	G		apq usdo-pq_Zt			дрт С-1710 µS/ст - С-2070 µS/ст	11/2 17/30 7/50 11/4	8° steel casing	521 530	→ 6° oper hole
BOH-5 (hole or was con	5' below ground surface aved in to 51.7' below ground surface ampleted)		50 5834.84	9	G					C=2010	7:50 11/4	8° steel casing	521 530	- 8° oper
BOH-5 (hole or was con	5' below ground surface aved in to 51.7' below ground surface at repleted)	 1	_							<u>μ</u> \$/cm	9:10			hale
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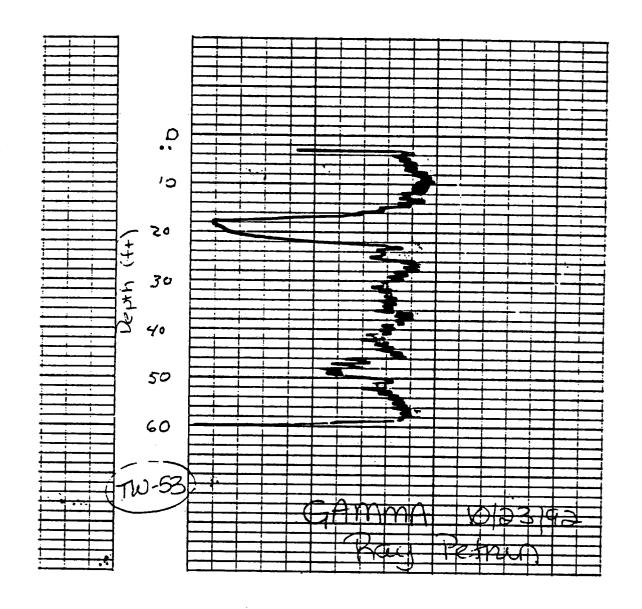
FIGURE A-6 (Sheet 2 of 2)

LITHOLOGY AND WELL COMPLETION - TW-58

MONSANTO/PHASE II RI REPORT/ID

#### ATTACHMENT H-2

## GEOPHYSICAL BOREHOLE LOGS FOR NEW WELLS



NATURAL GAMMA LOG (PRIOR TO WELL COMPLETION) — TW-53 MONSANTO/PHASE II RI/ID

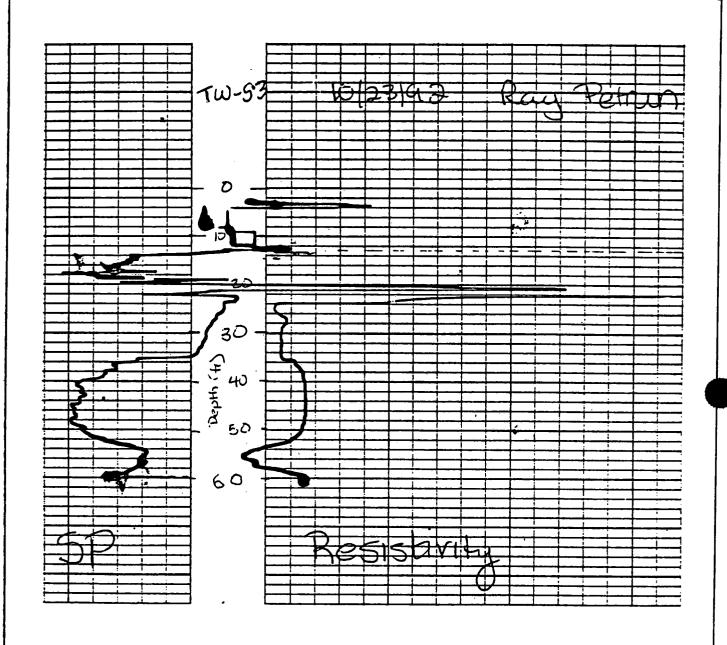
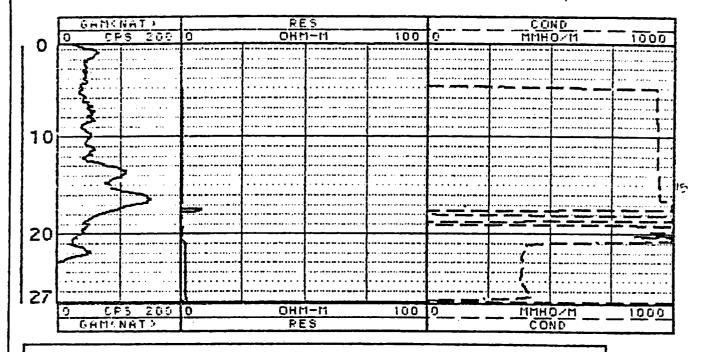


FIGURE B-2
RESISTIVITY AND SPONTANEOUS POTENTIAL
LOGS (PRIOR TO WELL COMPLETION) - TW-53
MONSANTO/PHASE II RI/ID



THS3	11/05/9	751
------	---------	-----

	TO	OGL CALIBRA	TION	TOOL = 95100	SERIAL NUM	5ER = 751	
	CAL-DATE	CAL-TIME	SRCE	SENSOR	RESPONSE	STANDARD	
0 1 2 3	OCTO1.92 OCTO1.92 NOVO4.92 NOVO4.92	08:39:12 08:39:12 01:54:44 01:54:44	00:00	GAMCNAT > GAMCNAT > COND COND	0.000 CPS 0.000 CPS 47800.000 CPS 113050.000 CPS	0.000 0.000 10.000 190.000	A

LOGIZ

DB 11/6/92

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conductorly

Scale

0-1,000

mucholm

FIGURE B-3
NATURAL GAMMA AND INDUCTION LOGS
(AFTER WELL COMPLETION) — TW-53
MONSANTO/PHASE II RIVID

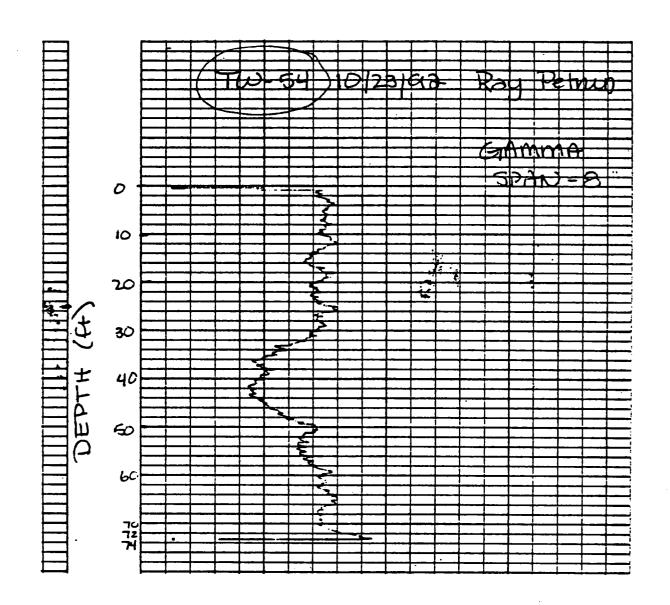


FIGURE B-4
NATURAL GAMMA LOG (PRIOR TO
WELL COMPLETION) - TW-54
MONSANTO/PHASE II RI/ID

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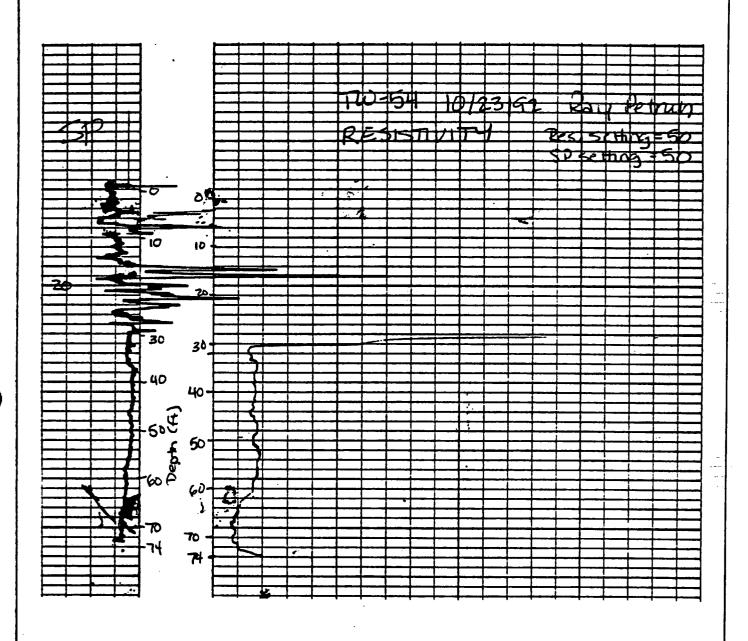
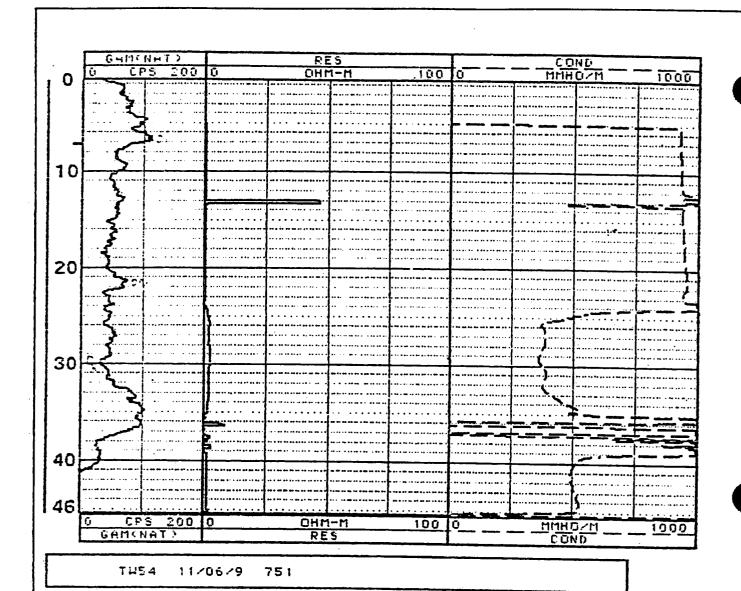


FIGURE B-5
RESISTIVITY AND SPONTANEOUS POTENTIAL
LOGS (PRIOR TO WELL COMPLETION) -- TW-54
MONSANTO/PHASE II RI/ID



	10	OL CALIBRA	TION	TOOL = 95100	SERIAL HUM	BER = 751
	CAL-DATE	CAL-TIME	SRCE	SENSOR	RESPONSE	STANDARD
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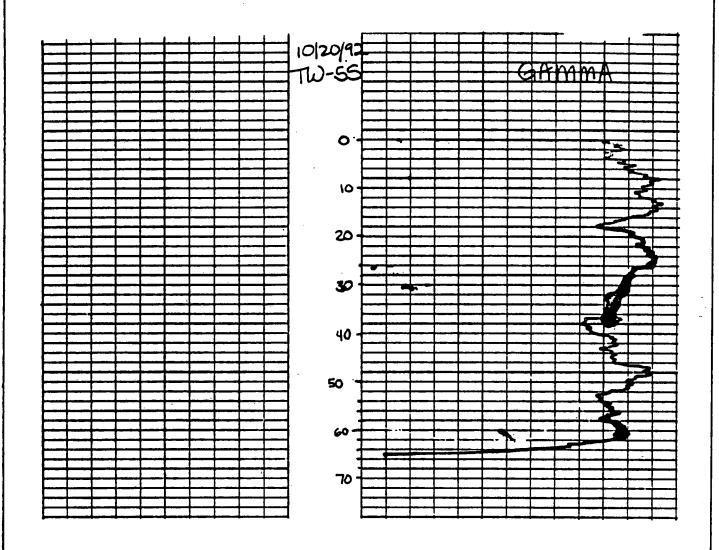
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Scale

0-1,000

FIGURE B-6
NATURAL GAMMA AND INDUCTION LOGS
(AFTER WELL COMPLETION) - TW-54
MONSANTO/PHASE II RIVID



Span = 9

Total depth
= 67

Ray Petnen

FIGURE B-7
NATURAL GAMMA LOG (PRIOR TO WELL COMPLETION) - TW-55
MONSANTO/PHASE II RIJID

15

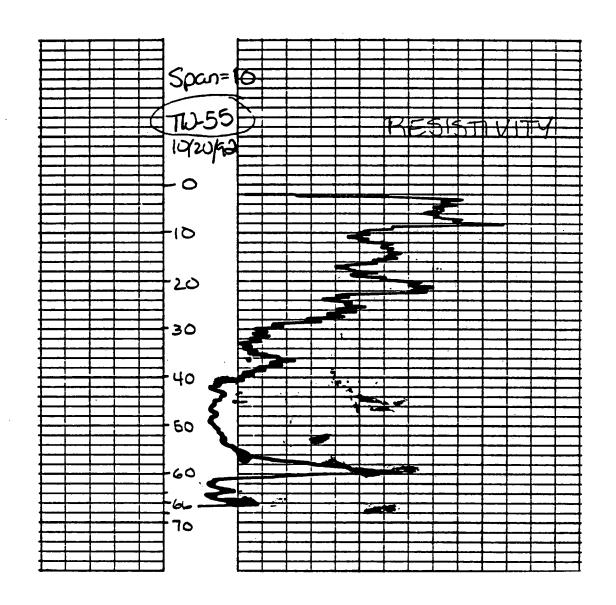


FIGURE B-8
RESISTIVITY LOG (PRIOR TO WELL COMPLETION) — TW-55
MONSANTO/PHASE II RIJID

PROJECT NO. 913 1101.608

DRAWING NO. 45213 DATE 3/23/93 DRAWN BY EA

SERIAL NUMBER =

1000

751

MUHD/W

1000

# CAL-DATE CAL-TIME SRCE SENSOR RESPONSE STANDARD O CCT01.92 08:39:12 0 GAM(NAT) 0.000 CPS 0.000 A 1 0CT01.92 08:39:12 0 GAM(NAT) 0.000 CPS 0.000 A 2 NOUG4.92 01:54:44 0 COND 47806.000 CPS 10.000 M 3 NOUG4.92 01:54:44 0 COND 113050.000 CPS 490.000 M FIGURE B-9 NATURAL GAMMA AND INDUCTION LOGS (AFTER WELL COMPLETION) — TW-55 MONSANTO/PHASE II RIVID

TOOL = 9510C

0 CPS 200 0 OHM-M 100 0 MMHO/M
GAM(NAT) RES COND

THSS-2 11/06/9 751

TOOL CALIBRATION

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GAM(NAT)

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CPS 200

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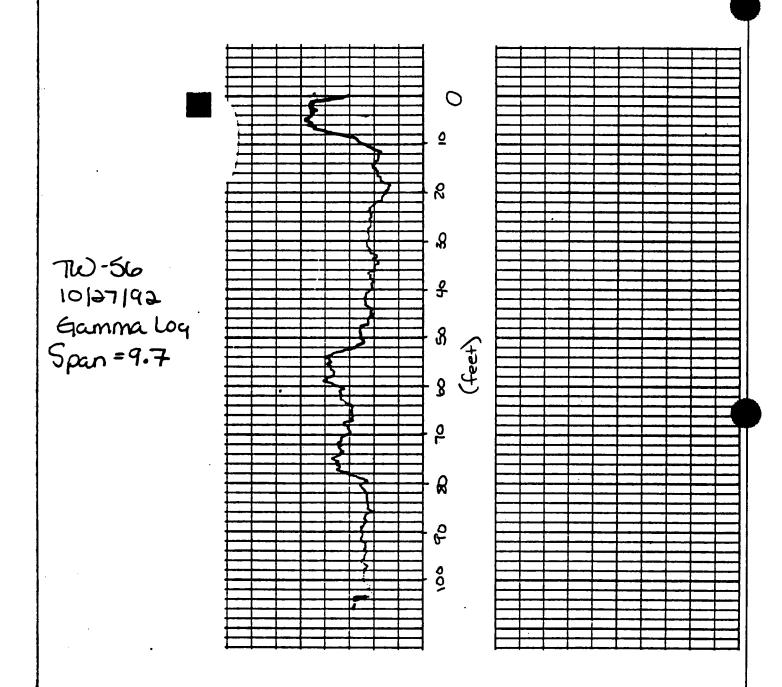
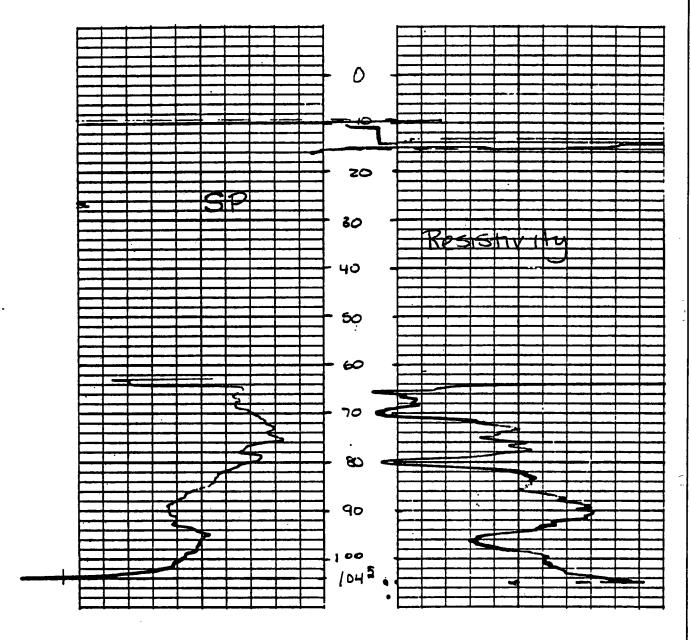


FIGURE B-10
NATURAL GAMMA LOG (PRIOR TO WELL COMPLETION) - TW-56
MONSANTO/PHASE II RI/ID

には、二



TW-56 10127192 SP & Res. to 1045 TD = 106 695

FIGURE B-11
RESISTIVITY AND SPONTANEOUS POTENTIAL LOGS (PRIOR TO WELL COMPLETION) - TW-56
MONSANTO/PHASE II RI/ID

1

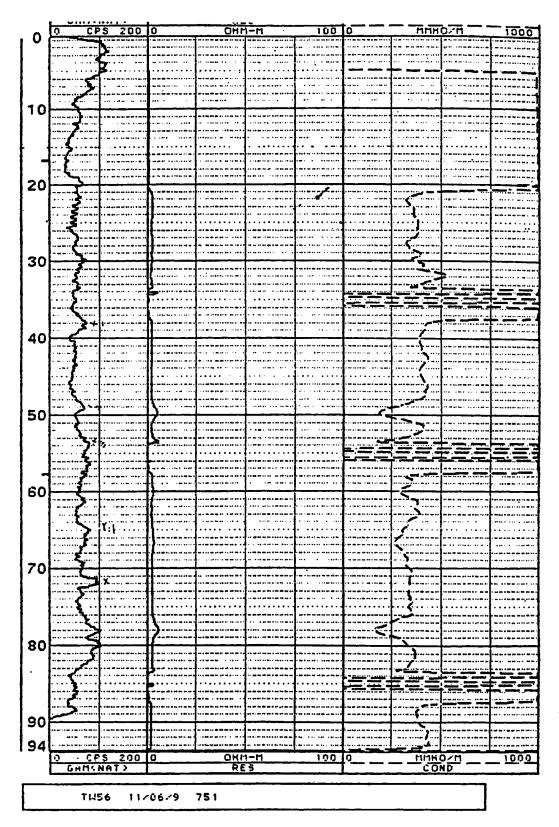


FIGURE B-12

NATURAL GAMMA AND INDUCTION LOGS
(AFTER WELL COMPLETION) - TW-56
MONSANTO/PHASE II RIVID

TW-57
Gamma log
10-23-92
Span 9.5
34.3 bgs

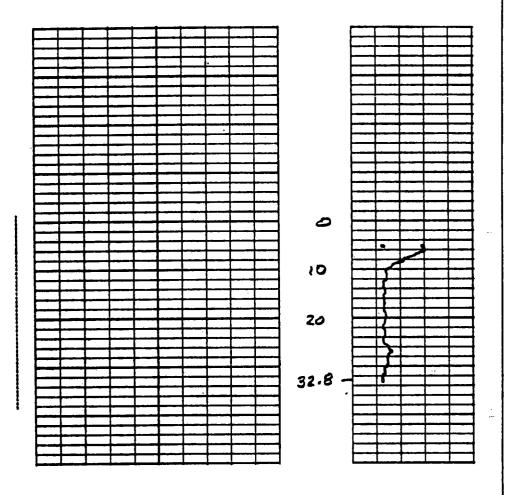
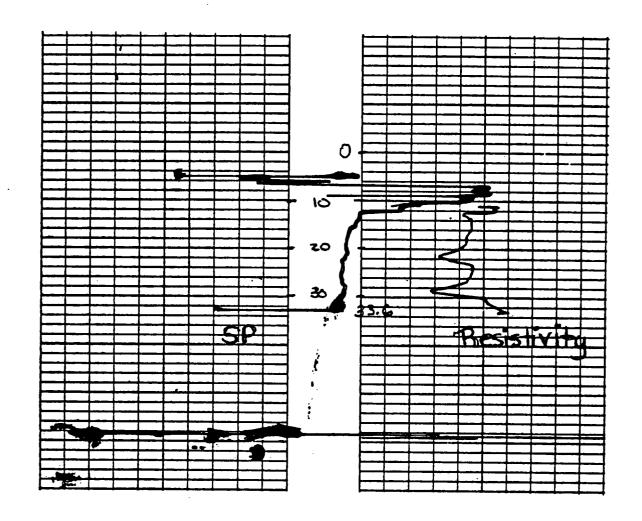


FIGURE B-13
NATURAL GAMMA LOG (PRIOR TO WELL COMPLETION) — TW-57
MONSANTO/PHASE II RI/ID

1220 #



TW-57

10-23-92

Span B

Sp & res.

Se Hing = 20

TD 34.3 bg s

FIGURE B-14
RESISTIVITY AND SPONTANEOUS POTENTIAL
LOGS (PRIOR TO WELL COMPLETION) - TW-57
MONSANTO/PHASE II RIID

#### **ATTACHMENT H-3**

# GEODETIC SURVEY INFORMATION FOR NEW WELLS AND ELECTROMAGNETIC SURVEY TRANSECT COORDINATES

A. A. HUDSON

and

# **ASSOCIATES**



14166 CLEVELAND RD. PRESTON, IDAHO 83263 (208) 427-6214 180 EAST 2nd SOUTH SODA SPRINGS IDAHO 83276 (208) 547-4141

December 22, 1992

DEC 28 1954

913-1101.605

Golder .....es

David Banton Golder Associates 4104 148th Avenue, NE Redmond, WA 98052

Dear David,

Enclosed are the Monsanto and state plane coordinates for the surveying we completed at Monsanto. Also enclosed is our invoice covering the remainder of the work done. Thank you for giving us an opportunity to work with you.

Sincerely,

Alex A. Hudson, PLS, PE

AAH/bjp Enclosure

# A. A. HUDSON

913-1101.605

#### and

# **ASSOCIATES**



14166 CLEVELAND RD. PRESTON, IDAHO 83263 (208) 427-6214 180 EAST 2nd SOUTH SODA SPRINGS IDAHO 83276 (208) 547-4141

		Monsanto Coo	ordinates _	Top of cement as Corrected any	
Points	Northing	Easting	M.P.	Grand Description Ground	
1	7352.5011	-10127.3436		EM-1 0+00	C
2	6408.1214	-10134.4565		EM-2 0+00	
3	5652.1078	-10140.1506		EM-3 0+00	
4	4801.8924	-10146.5542		EM-4 0+00	
5	7440.4467	-14727.9342		EM-1 46+00	
6	6196.0671	-14735.0470		EM-2 46+00	
7	5726.6703	-14040.6513		EM-3 39+00	
8	4876.4550	-14047.0549		EM-4 39+00	
9	6348.2578	-10598.5356	5910.00	5908.40 Well TW-56 5907.70	
10	6427.1402	-11133.9247	5886.33	5884.64 Well TW-55 6884.33	
11	6436.4812	-11633.2207	5888.96	5887.79 Well TW-54 5086.70	
12	6446.5431	-12133.9750	5880.39	5879.56 Well TW-53 5878.35	
13		-11402.1415	5892.74	5890.32 Well TW-58 5889.84	
14		-12782.8805	5952.54	5950.38 Well TW-57 5950.36	

State Plane Coordinates

				as,	
			7	Top of Cement	(grected ^{os} )
Points	Northing	Easting	M.P.	Graffid Descripti	on Ground
1	368989.7057	656732.5993		EM-1 0+00	4.000.00
2	368045.6152	636739.0828		EM-2 0+00	
3	367289.8330	656744.2731		EM-3 0+00	
4	366439.8780	656750.1101		EM-4 0+00	
5	369011.3940	652132.6505		EM-1 46+00	4
6	368067.3035	652139.1340		EM-2 46+00	
7	367308.2209	652844.3165		EM-3 39+00	
8	366458.2659	652850.1535		EN-4 39+00	
9	367979.0964	656276.0578	5910.00	5908.40 Well TW-56	_
10	368050.2397	655739.7553	5886.33	5884.64 Well TW-55	
11	368052.3900	655240.5318	5888.96	5887.79 Well TW-54	
12	368055.2399	654739.8404	5880.39	5879.56 Well TW-53	
13	368980.1644	655458.2033	5892.74	5890.32 Well TW-58	
14	374365.9107		5952.54	5950.38 Well TW-57	
				adding Hell IM-01	2730 - A

DEC 22 1992

# APPENDIX H-5 WELL INVENTORY

#### SODA SPRINGS AREA WELL INVENTORY

A well inventory of the Soda Springs area was conducted in 1992 to determine the number, location, and use of wells located within approximately 24 square miles surrounding the Monsanto Plant. The area covered in this inventory includes wells that may tap groundwater downgradient of the Plant, and upgradient wells that may potentially be used to obtain background groundwater quality data. A compilation of existing wells for this area was prepared from: 1) driller's well logs on file with the Idaho Department of Water Resources (IDWR), obtained from the Idaho Falls and Boise offices; 2) a listing of water rights on file with the IDWR in Boise; 3) well information obtained from the United States Geological Survey (USGS) Water Resources Division in Boise; and 4) a review of published literature.

The well inventory information was updated in June 1993 by reviewing files from the IDWR and from the USGS for any new wells within approximately 24 square miles surrounding the Monsanto Plant. In addition, a drinking-water database obtained from the City of Soda Springs was reviewed. A field survey was conducted of wells located approximately 2.5 miles downgradient of the Monsanto Plant to verify well location and use. This downgradient area represents the area that could potentially be affected by groundwater flowing south from the Monsanto Plant before discharging into Soda Creek, Bear River, and Alexander Reservoir. Well owners were interviewed if possible and field survey forms were completed for each well. Survey forms and well logs (when available) are provided in this appendix. The inventory does not include monitoring wells owned by Monsanto or Kerr-McGee.

Well uses were broken down into several categories including: domestic, heating, industrial, stock watering, testing, de-watering, and irrigation. The results of this survey area summarized in Table H-1. The well ID numbers in Table H-1 correspond to well locations shown on Figure H-2. Table P-1 includes other names by which the well may be known, well location, well owner information, well depth, year drilled, proposed use of well water, and well information sources. The well locations are sorted by township, range, section, quarter section, and 40 acre tract and are derived from the system utilized by the USGS in Idaho and is presented in Figure H-3. Proposed water use definitions are as follows:

A - Abandoned

D - Domestic

DW - De-watering

H - Heating

IN - Industrial

IR - Irrigation

M - Mining

S - Stock

T - Testing

When two or more informational sources were available and were contradictory, the subsequent information was placed in parentheses or brackets in order to distinguish from the first. The well informational source definitions are as follows:

FV - field verification

SS - City of Soda Springs drinking-water database

WL - Driller's well log

USGS - United States Geological Survey - Water Resources Division

WR - Listing of water rights

Results of this survey indicate the majority of wells considered in the well inventory are for domestic use. Secondary uses include irrigation and stock watering.

# TABLE H-1

Well No.	Location	Name and Address	Depth (ft)	Year Drilled	Water Use	Source of Information
1	8S 41E 24ba	Mrs. Hilda Thompson Soda Springs, ID	19	1965	D	WL
2	85 41E 25bd	Monsanto Co. (off-site) Box 816 Soda Springs, ID	195	1989	IR [M]	WL, [WR]
3	8S 41E 25bd	Wells Cargo, Inc. Soda Springs, ID	69	1966	IR	WL
4	8S 41E 36cc	David Clegg 399 N 2nd E Soda Springs, ID	212	1981	D	WL
5	8S 42E 19bab1	Lav Heber	25	1967	S	USGS
6	8S 42E 20aa	Carl E. and Carelyn Lowry	?	7	D	WR
7	8S 42E 20aa [8S 42E 20da]	Brent Maughan [William B. Maughan] Soda Springs, ID	12.7	1974 (1975)	D [IR,S,D]	WL,(USGS),[WR]
8	8S 42E 20ad [8S 42E 20aaa1)	Ray Nelson Box 344 Soda Springs, ID	147	1975	D	WL,(USGS),WR
9	8S 42E 20bcc1	Ira Ellis	50	1927	D	USGS
10	8S 42E 20da (8S 42E 20dab1)	Wayne Porter (Cove Construction) Soda Springs, ID	125	1964	(IN)	WL, (USGS)
11	8S 42E 20dad1	Myrtle Campbell	80	1937	D	USGS
12	8S 42E 21bcc	N.A. Degerstrom, Inc.	?	7	IN	WR
13	8S 42E 28bc	Don C. Panting	?	?	S,D	WR
14	8S 42E 28dc	Bill Vandegriff Soda Springs, ID	115	1978	D	WL
15	8S 42E 28dc (8S 42E 28cdc1)	Archie Vonberg Soda Springs, ID	90	1966	(D)	WL, (USGS)
16	8S 42E 29aa	A.J. Garn Soda Springs, ID	74	1976	D	WL
17	8S 42E 29aba1	Tom Cellan	?	1949	D	USGS
18	8S 42E 29ac	Eugene A. & Opal M. Anderson Soda Springs, ID	65	1980	D	WL
19	8S 42E 29dd	Van Garner P.O. Box 305 Soda Springs, ID	78	1983	D,S	WL
20	8S 42E 30dd	Monsanto Chemical Co.	?	?	IN	WR
21	8S 42E 31ad	Monsanto Chemical Co.	?	?	IN	WR
22	8S 42E 31ad	Monsanto Chemical Co.	?	?	IN	WR
23	85 42E 31ad	Monsanto Chemical Co.	?	?	IN	WR
24	8S 42E 31da	Monsanto Chemical Co.	?	?	IN	WR

# TABLE H-1 (Page 2 of 4)

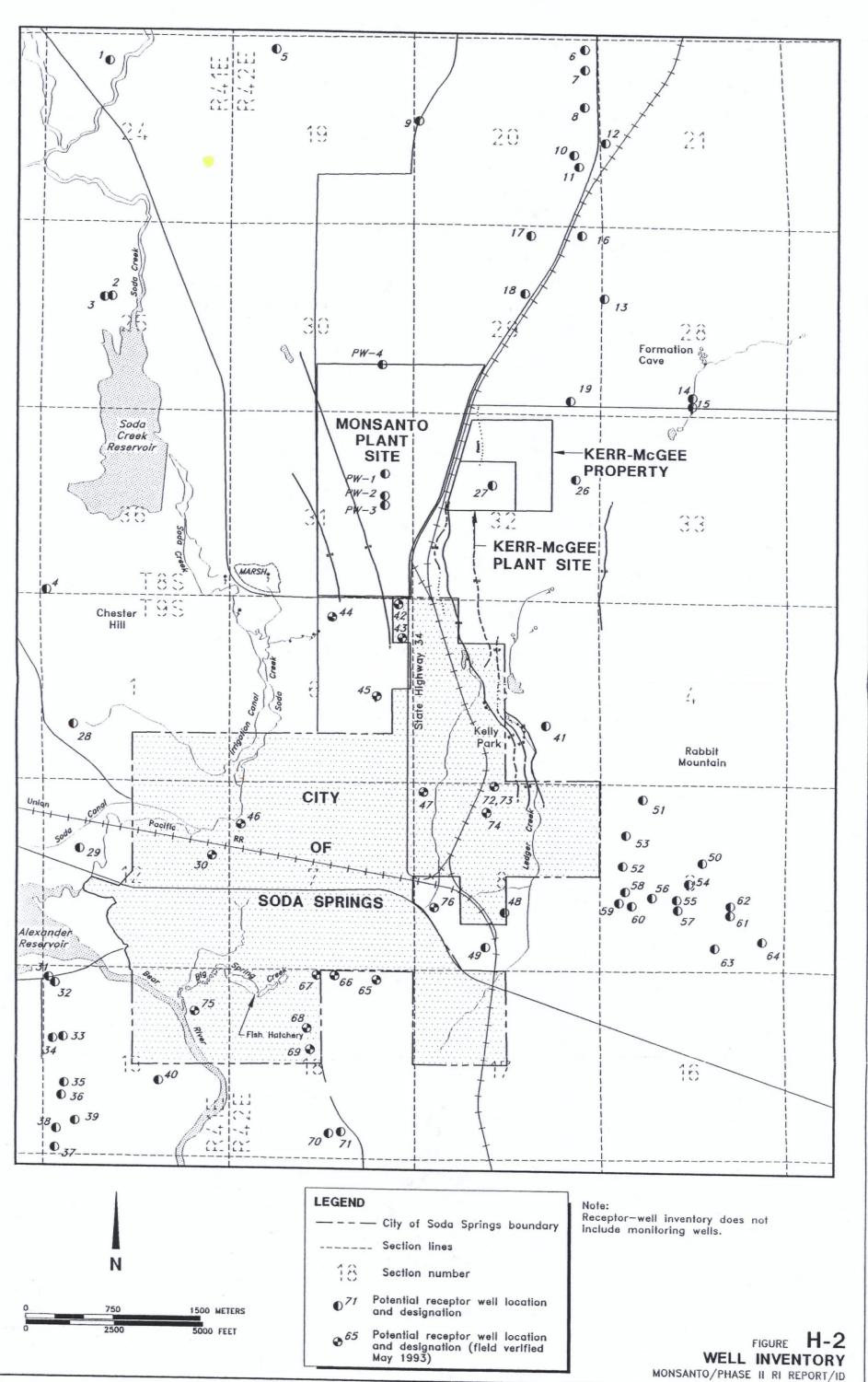
Well No.	Location	Name and Address	Depth (ft)	Year Drilled	Water Use	Source of Information
25	8S 42E 31ad	Wells Cargo Inc. P.O. Box 11511 Reno, Nevada	390	1966	IN	WL .
26	8S 42E 32ad (8S 42E 30bdd1)	Wells Cargo Inc. P.O. Box 11511 Reno, Nevada	120	1966 (1967)	IN	WL,(USGS)
27	8S 42E 32bd	Kerr-McGee Chemical Corp.	?	?	IN	WR
28	9S 41E 1cbd1	William Corbett	?	1966	IR	USGS
29	9S 41E 12bc	Boyd Mason 120 E 2nd St. Soda Springs, ID	88	1975	Т	WL
30	9S 41E 12add1	City of Soda Springs	315	1937	Gyser	USGS
31	9S 41E 13bb (9S 41E 13bbb1)	Howard Hahn (Howard Hand) Soda Springs, ID	77	1966	D	WL,(USGS)
32.	9S 41E 13bb	Dennis Hansen 376 N 2nd E Soda Springs, ID	65	1977	D	WL
33	9S 41E 13bc	Steve Corder (SW of city) Soda Springs, ID	122	1983	D	WL
34	9S 41E 13bc	Charles Schwartz 356 S 2nd E Soda Springs, ID	135	1978	D	WL.
<b>3</b> 5	9S 41E 13cb	Randy Corder 159 W 2nd S Soda Springs, ID	130	1978	D	WL
36	9S 41E 13cb	Charles Stewart Soda Springs, ID	122	1985	D	WL
.37	9S 41E 13cc (9S 41E 13ccc1)	Fred Larsen Soda Springs, ID	138	1974	D	WL,(USGS)
38	9S 41E 13cc	Merlin McCulloch 348 S. Main Soda Springs, ID	140	1981	D	WL
39	9S 41E 13cc	Max Shell Soda Springs, ID	165	1978	D	WL
<b>4</b> 0	9S 41E 13db (9S 41E 13bcc1)	William Corder Soda Springs, ID	102	1967	D	WL,(USGS)
41	9S 42E 5db	Leroy Stevens 340 Rose Ave. Soda Springs, ID	78	1974	D ·	WL
42	95 42E 6aa	Fan Corporation - Gene Nicholas Soda Springs, ID	86	1966	D	WL

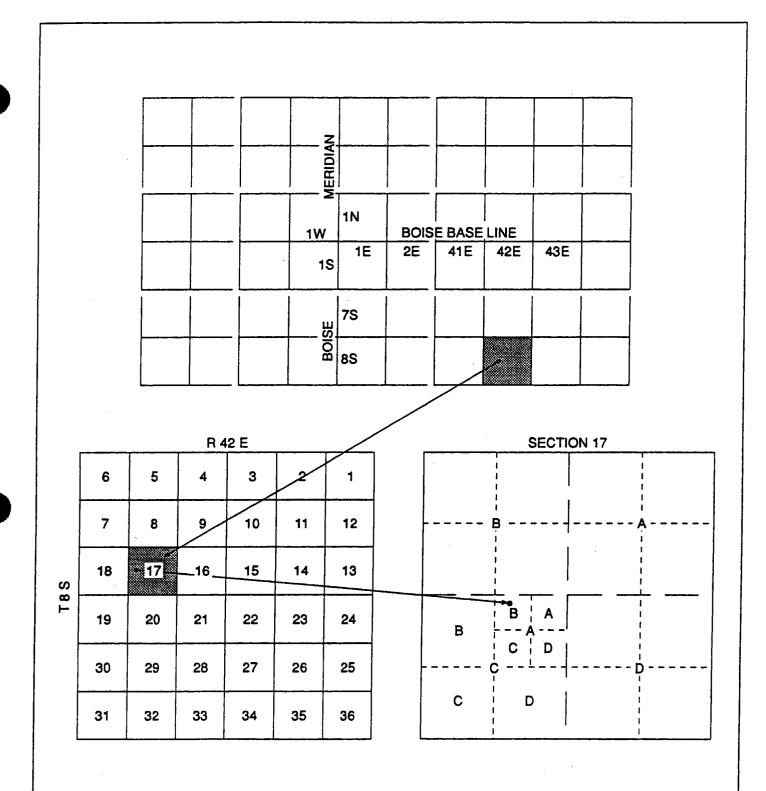
# TABLE H-1 (Page 3 of 4)

Well No.	Location	Name and Address	Depth (ft)	Year Drilled	Water Use	Source of Information
<b>4</b> 3	9S 42E 6ad	Ref. Chem. Engineering & Construction Co. Soda Springs, ID	106	1967	D	WL
44	9S 42E 6ba (9S 42E 6ab)	Lynn Harris Soda Springs, ID	64	1969	D	WL,[WR]
45	9S 42E 6da (9S 42E 6add1)	Larry Lewis Soda Springs, ID	105	1974	D	WL,(USGS),WR
46	9S 42E 7bb	Soda Springs School Soda Springs, ID	800	1982	т [Н]	WL,[WR]
47	9S 42E 8bb	Ralph J. Marriott 760 E. Hooper Ave. Soda Springs, ID	40	1968	D (yard)	WL
48	9S 42E 8ca	Steve Butikofer (East of city) Soda Springs, ID	2/40	1981	D	WL
49 ·	9S 42E 8cd	Richard Hendricks 161 E. Oneida Preston, ID	135	1978	D	WL
50	95 42E 9ac	Albert Christman 80 N. Hooper Ave. (Wood Canyon #3) Soda Springs, ID	305	1978	D	WL.
51	9S 42E 9bb	Dean Martinsen (East of city) Soda Springs, ID	415	1977	D -	WL.
52.	9S 42E 9bc	Leonard D. Owens Jr. 160 N. Main Soda Springs, ID	426	1976	D	WL
53	9S 42E 9bc	Stephen Penn (East of city) Soda Springs, ID	<b>42</b> 0	1981	D	WL
54	9S 42E 9ca	Ron Bullock (Wood Canyon #2, lot #5, block #2) Soda Springs, ID	<b>26</b> 7	1978	D	WL
55	9S 42E 9ca	Mike E. McCabe (Wood Canyon #1, Lot #5, Block 1) Soda Springs, ID	365	1978	D	WL
56	9S 42E 9ca	Douglas R. Moore Soda Springs, ID	293	1976	D	WL
57	9S 42E 9cad1	Encil Hines	365	1955	s,DW	USGS
58	9S 42E 9cb (9S 42E 9cbc1)	Eddie Lee [Eddie and Donna Lee] Soda Springs, ID	219	1969	D [IR,D]	WL,(USGS),[WR]
59	95 42E 9db	C.E. Lundin	7	?	D	WR
60	95 42E 9db	Norman Sparrow Soda Springs, ID	285	1979	D	WL

# TABLE H-1 (Page 4 of 4)

Well No.	Location	Name and Address	Depth (ft)	Year Drilled	Water Use	Source of Information
61	9S 42E 9db (9S 42E 9dac1)	Dale Dunn Soda Springs, ID	175	1967 (1965)	D,S	WL,(USGS)
62	9S 42E 9db	Byron Seeley Soda Springs, ID	247	1980	D [IR,D]	WL,[WR]
63	9S 42E 9dc (9S 42E 9dca1)	Lowel Thomas Soda Springs, ID	150	1963	D	WL,(USGS)
64	9S 42E 9dd	Dorsie (Bill) Hines Soda Springs, ID	80	1968	D	WL
65	9S 42E 18aa	Val Gibson Box 357 Grace, ID	150	1984	IR	WL
66	9S 42E 18ab	Larry Hildreth 261 S 3rd E Soda Springs, ID	45	1983	D	WL
67	9S 42E 18ab	Val M. Steele	?	?	IR,S,D	WR
68	9S 42E 18ad (9S 42E 18bdd1)	Stanford Steel Soda Springs, ID	72	1966	D	WL,(USGS)
69	9S 42E 18bd (9S 42E 18caa1)	Mark Steele 900 Block S 3rd E Soda Springs, ID	108	1975	D	WL,(USGS)
<b>7</b> 0	9S 42E 18dc	LaDell Porter Soda Springs, ID	165	1975	D,IR	WL, WR
71	9S 42E 18dc	Robert Ringel Soda Springs, ID	160	1973	D [IR,S,D]	WL, [WR]





Well Location: 8S 42E 17cab1

FIGURE H-3
USGS WELL NUMBERING
SYSTEM FOR IDAHO
MONSANTO/PHASE II RI REPORT/ID

SODA SPRINGS AREA WELL INVENTORY FORM
30
Well Number: GUSLY Other Well ID: Date: 63 93 Surveyor: Uates
Name of Well Owner: City of Soda Springs
Well Location
Owner's Address: 9 West 2nd South Soda Springe 10 832770
Street Address of Residential Well Site if Different from Owner:
no address
Current Well Use: tourism + to rechice subsurface pressure
Verification by Owner/Occupant of Well Use:  (signature)
Well Water in Contact with Humans: Yes No
Well Coordinates: Lat: Long: Long:
Township 95 Range: 4] E Section (nearest 1/4 1/4:): 12 9E1/4 of N
Well Specifications: Installation Date: 1937 Total Danth (5): 0151
Well Specifications:  Installation Date: 1937 Total Depth (ft): 3151  Well Construction Type:
Well Specifications:  Installation Date: 1937 Total Depth (ft): 3151  Well Construction Type: Cutisian  Well Access for Sounding: 00
Well Specifications:  Installation Date: 1937 Total Depth (ft): 3151  Well Construction Type: Crtisian
Well Specifications:  Installation Date:
Well Specifications:  Installation Date:
Well Specifications:  Installation Date: 1937 Total Depth (ft): 3151  Well Construction Type:  Pump System Type: Crtisian  Well Access for Sounding: 00  Other Information:  Photograph Taken: No Yes Photo Number: 2  Well Log Available: No Yes  Well Log Obtained: Yes

SODA SPRINGS AR	EA WELL INVENTORY FORM
Well Number: 42 Other Well ID: Fan Corp.	Date: 639 Surveyor: Uates
Name of Well Owner: MONSON	o Chemical Company
Well Location	. •
Owner's Address:  PO P	0x 916, Hwy 34 a spanp ID 83276
Street Address of Residential Well	Site if Different from Owner:
Current Well Use:	use
Verification by Owner/Occupant of Well U	
of owner occupant of then of	(signature)
Well Water in Contact with Humans:	Yes No 🔀
Well Coordinates: Lat:	Long:
Township 95 Range: 47 E	Section (nearest 1/4 1/4:): 6 NE/4 OF NE/6
Well Specifications: Installation Date: 900 Well Construction Type:	Total Depth (ft): 86
Pump System Type:	
Well Access for Sounding:	
Other Information:	
Photograph Taken: V No Well Log Available: No Well Log Obtained: No	
Other: Well 15 located	on property of
old bar. (Punderos	Bar). Exact well
	ified, Property is fenced
and secured. Information Compan	otion obtained from
•	

Well Log Form 1

Department of Reclamation

# WELL LOG AND REPORT TO THE STATE RECLAMATION ENGINEER OF IDAHO .....

SUBLIT WITHIN TO DAYS AFTER COLPLETION OF SELL: SEE IDAHO STATUTES 42-238

where Pan Corporation Gene Richolas  Iddress Soda Springs Idaho  Miller Ivan Bortz  Iddress Crace, Idaho  Well locationE/Z	<b>y</b>
Ivan Bortz  ddress_Grees, Idaho  Vell locationE/E Vs E/E Vs Sec. 8 , T. 6 19/5, R. 42 E/W  Ize of drilled hole_6"	<b>%</b>
Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.   Sec.	
Vell locationE/E	
Dive depth to standing water from the ground SIfts Water temp. ————————————————————————————————————	
Cive depth to standing water from the ground SIfte Water temp	¼
Give depth to standing water from the ground 61ft Water temp	!
Size of pump and motor used to make lest.  Length of time of test.  M flowing well, give flow	
lest delivery was	
Length of time of testhoursminutes.  If flowing well, give flowc.f.s. org.p.m. and of shut off pressure  If flowing well, described control works	
If flowing well, give flow	
M flowing well, described control works  Water will be used for Demonstic	
Water will be used for Domestie	
Water will be used for Domestie	
Thickness of casing.  Casing material Black steel pipe  (ever. concurre, wood, eve.)  (ever. concurre, wood, eve.)  (casing tr. in Diameter, length and location of casing	
Diameter, length and location of casing	
Diam.  Casing From To Length Remarks—seals, grouting, etc.  Parish and location of casing — ** Top of hole to 86ft. 20ft. of bottom perefer (Casing 12" IN DIAMETER ON LESS, GIVE INSIDE DIAMETER)  Casing From To Length Remarks—seals, grouting, etc.	
CASING RECORD  Casing Foot Foot Longth Remarks—seals, grouting, etc.	ated
CASING RECORD  Casing From To Longth Remarks—seals, grouting, etc.	
CASING RECORD  Diam. From To Longth Remarks—seals, grouting, etc.	
Diam. From To Length Remarks—seals, grouting, etc.	
Casing Foot Foot Longin	
4" • to 86	
Number and size of perforations 80—I/8 x 6located 60feet to 86feet fra	ım groun
Date of commencement of well May 14, 1966 Date of completion of welkay. 16, 1966	
	-4

43-42E- 6 NENE

		WELL LOG			
From Foet	To Feet	Type of Material		Valor beering	Castng Perforated Ann. Yes or No.
0	8	Soil			
в	15	law			
I5	50	Sand & lava cinders	<del></del>		
40	50	Noist			
50	60	Lava (seep of water @ 60ft.)		708	
60	75	Sand à lava cinders		y:0 £	708
75	86	Broken lava & water		yes	yes
				_	
	-				
					-
	-				
				<del> </del>	_
		If more space is required use Sheet No. 2			

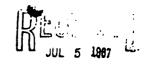
#### WELL DRILLER'S STATEMENT

This well was drilled under my supervision and	I the above information is complete, true and correct to the best of
my knowledge and belief.	
	Signed Janes Berg

δĪ

Well Driller's Helper_

SODA SPRINGS AREA WELL INVENTORY FORM	
43	
Well Number: Advantage Electric Date: 6/3/93 Other Well ID: Surveyor: C Uates  Ref. Chem. Well	
Name of Well Owner: Advantage Electric	
Well Location	
Owner's Address: 701 N. Hooper Soda Springs ID 83276	
Street Address of Residential Well Site if Different from Owner:	
NA	
Current Well Use: abandoned - (not filed in with grout)	
Verification by Owner/Occupant of Well Use: Formu B Wood	
(signature)	
Well Water in Contact with Humans: Yes No	
Well Coordinates: Lat: Long:	
System:	cy
System:	
System:  Township 95 Range: 42E Section (nearest 1/4 1/4:); 6 SE/4 of NE/4  (LOCA) 6 DE/4 of NE/4  Well Specifications: Installation Date: ~ 1961-1962 Total Depth (ft): 135	cy 106')
System:  Township 95 Range: 42E Section (nearest 1/4 1/4:): 65E/4 of NE/4  (LOCA) 6 DE/4 of NE/4  Well Specifications:  Installation Date: 1961-1962 Total Depth (fi): 135  Well Construction Type: 6" Store 1 Cusing (Well log-depth-	
System:  Township 95 Range: 42E Section (nearest 1/4 1/4:): 65E/4 of NE/4  (LOCA) 6DE/4 of NE/4  Well Specifications: Installation Date: 1961-1962 Total Depth (ft): 135  Well Construction Type: 6" Store 1 Cusing (Well log-rights)  Pump System Type: Pump mas been pulled out	
System:  Township 95 Range: 42E Section (nearest 1/4 1/4:): 65E/4 of NE/4  (LOCA) 6DE/4 of NE/4  Well Specifications: Installation Date: 1961-1962 Total Depth (ft): 135  Well Construction Type: 6" Store 1 Cusing (Well log-rights)  Pump System Type: Pump mas been pulled out	
System:  Township 95 Range: 42E Section (nearest 1/4 1/4:): 65E/4 of NE /4  (LOGA) G NE /4 of NE /4  Well Specifications: Installation Date: 1961-1962 Total Depth (ft): 135  Well Construction Type: 6" Stort Cusing (Well 10g-1epth=  Pump System Type: pump mas been pulled out  Well Access for Sounding: 100	
System:  Township 95 Range: 42E Section (nearest 1/4 1/4:): 65E/4 of NE/4  (LOCA) (DE'/4 of NE/4  Well Specifications: Installation Date: 1961-1962 Total Depth (ft): 135   Well Construction Type: 6" Stre! Cusing (Well Ing-define  Pump System Type: Pump miss been pulled out  Well Access for Sounding: 100  Other Information:  Photograph Taken: 100 Yes Photo Number: 118	
System:  Township 95 Range: 42E Section (nearest 1/4 1/4:): 63E/4 of NE/4  (LOAA) 6 DE/4 of NE/4  Well Specifications:  Installation Date: 1961-1962 Total Depth (ft): 135  Well Construction Type: 6" Stal   Casing (Well 10g-regin=  Pump System Type: pump mg heen pulled out  Well Access for Sounding: 10  Other Information:  Photograph Taken: No Yes Photo Number: 1) M  Well Log Available: No Yes  Well Log Obtained: No Yes	
System:  Township 95 Range: 42E Section (nearest 1/4 1/4:): 65E/4 of NE/4  (600) 6 DE/4 of NE/4  Well Specifications: Installation Date: 1961-1962 Total Depth (ft): 135   Well Construction Type: 6" Stall Cusing (Well log-neath=  Pump System Type: pump ms been pulled out  Well Access for Sounding: 10  Other Information:  Photograph Taken: 100 Yes Photo Number: 11/4  Well Log Available: 100 Yes  Well Log Obtained: 100 Yes  Other: 1504 any tace of Well 10025100	



#### REPORT OF WELL DRILLER State of Idaho

State law requires that this report shall be filed with the Benefings of sections in Engineer within 30 days after completion or abandonment of the well. Size of drilled hole: 6" Total depth of well: IOSTL S'anding water level below ground: 68ft. Temp.
Fahr. Test delivery: Total ' WELL OWNER: NameRef , Chem. Engineering & Construction Co. Address Soda, Springs, Id aho Fahr. Test delivery: SPI
or cfs Pump? Paul X
Size of pump and motor used to make test: Owner's Permit No. HATURE OF WORK (check): Replacement well Length of time of test: Hrs. New well x Deepened Abandoned Water is to be used for: Domestic METEOD OF CONSTRUCTION: Rotary X Cable Dug Other_ (explain) Welded Tt. CASING SCHEDULE: Threaded 5 1/2 "Diam. from -2 ft. to 4 4 "Diam. from ft. to YES OR NO FRON TO _ft. to _ft. to ſŧ. FEET FEET "Diam. from_ "Diam. from • _ft. to Sand y loose rook Material: Thickness of casing: A. Steel concrete wood other 12 55 70 FOOK 56 Red lare an red ash 100 Crevaced law with water 90 t. yes 75 (explain) PERFORATED? Yes No Type of 90 100 105 Black Water perforator used: Size of perforations: It. to perforations from perforations from It. to perforations from It. to It. Perforations from YAS SCREEN INSTALLED? Yes Manufacturer's name Model No. Diam. Slot size Set from ft. to Diam. Slot size Set from ft. to CONSTRUCTION: Well gravel packed? Tes No. E size of gravel Gravel
placed from ft. to ft. Surface seal
provided? Yes No To what depth?

ft. Material used in seal: Did any strata contain unusable water? Yes No. Type of water:

Depth of strata

ft. Hethod of sealing Depth of strata_ strata off: Surface casing used? Yes Cemented in place? Yes Locate well in section Work started: June, 20, 1967 Work finished: June, 23, 1967 Well Driller's Statement: This well was drilled under my supervision and this report is true to the best of my knowledge.
Name: Ivan Borts Address: Grace, Id who Signed by: Date: License No. LOCATION OF WELL: County Rear of - 4:

Use other side for additional remarks

15.315

1 X Sec. 15 T. 9 A/S R. 117 E/A

SODA SPRIN	IGS AREA WELL INVENTORY FORM
Well Number: Harris L Other Well ID: NA	Date: 6/3/93 Surveyor: Kutes + Norton
Name of Well Owner: Hon:	santo Chemical Co.
Well Location	
Owner's Address:	Box 816, Highway 34 Socia Spring ID 83276
Street Address of Residentia	Well Site if Different from Owner:
	788 bivernment Dam Prad Soda Springp ID 83276
Current Well Use: 100	current use except for ironmental sampling
Verification by Owner/Occupant of	(signature)
Well Water in Contact with Humans	: Yes No
Svetem:	Long:
System:	HQE Section (nearest 1/4 1/4:);
System:	HQE Section (nearest 1/4 1/4:);  LO NW/4 of NE/4 Bass cy
System: Township 98 Range: Well Specifications: Installation Date: 910	HQE Section (nearest 1/4 1/4:);  6 NW/4 of NE/4 Bases cy
System: Township 95 Range: Well Specifications: Installation Date:910 Well Construction Type:	HQE Section (nearest 1/4 1/4:);  LO NW/4 of NE/4 BOOK cy  Total Depth (ft): Ut
System:	HQE Section (nearest 1/4 1/4:);  LO NW/4 of NE/4 BOOK cy  Total Depth (ft): Ut
System:	HQE Section (nearest 1/4 1/4:);  LO NW/4 of NE/4 BOOK cy  Total Depth (ft): Ut
System: Township S Range:  Well Specifications:	HQE Section (nearest 1/4 1/4:):  LONW'/4 OF NE'/4 BOOKS CYF  Total Depth (ft):  LONG PUMP INSTALLED  Yes Photo Number: 26  Yes
System:	HQE Section (nearest 1/4 1/4:):  LONW'/4 OF NE/4 BROWS CYF  Total Depth (ft):  LOND PUMP INSTALLED  Yes Photo Number: 26  No Yes  No Yes  No Yes  Yes

# USE TYPEWRITER OR EBALL POINT PEN

#### State of Idaho Department of Reclamation

WELL DRILLER'S REPORT

State law requires that this report be filed with the State Reclamation Engineer, within 30 days after completion or abandonment of the well.

1. WELL OWNER			LEVEL		7		
Name	Static water level 15 Teet below land surface Flowing?  Yes  No G.P.M. flow Temperature F. Quality						
Address SODA SPRINGS PALLO	i ^A T	empera	ture	P.S. Quality	<del></del>		
Owner's Permit No.	C	ontrolle	d by	□ Valve □ Cap □ Plug	• "		
2. NATURE OF WORK	8.1W		EST DA	TA A A A A A A A A A A A A A A A A A A			
☐ New well □ Deepened □ Replacement	1 0	) Pump		⊠ Bailer □ Other	•		
☐ Abandoned (describe method of abandoning)	. D	ischarge	G.P.M.	Draw Down \ Hours Pur	·		
			11·4:		<u> </u>		
	<u>.</u>		-9 ° ¥.		7		
3. PROPOSED USE	,	J Z		ne .			
Domestic Irrigation I Test	Hole .		.ÓGIC L		Water		
☐ Municipal ☐ Industrial ☐ Stock	Diam.	From	To /7	Material  LOOSE LAYA ROCK & COAL	Yes No		
4. METHOD DRILLED		17	3.6	CREVICED LAYA	7		
◯ Cable □ Rotory □ Dug □ Other		36	57 61	BROKEY ZAYA" SEFT	P		
5. WELL CONSTRUCTION		61	64	LAYA MED	4.		
134 Diameter of hole 6 inches Total depth 644 feet		3 PA	. F	्राप्त का अन्य क्षेत्र क्षेत्र क्षेत्र का क्षेत्र का का का का का का का कि	ेख र		
Casing schedule:  Steel	• • • •	25.5	33.4	The second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of th	100		
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inches feet feet			73 71 11	The state of the state of the state of			
inches inches feet feet feet inches feet feet feet	***	17.00	24.	The transfer of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property of the property o	550 M 1523 4		
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/ : 15 / 15 / 1 / 15 / 15 / 15 / 15 / 15		<u> </u>		7. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
Perforated? ☐ Yes ☐ No How perforated? ☐ Factory ☐ Knife ☑ Torch				4 No. 10 Programme 12	11		
Size of perforation inches by inches Number To				Art 19 gard to the second			
15 perforations 58 feet 62 feet			·	the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s	-		
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Well screen installed? ☐ Yes ☐ No			٦.	order of any Company Nationals.	1		
Manufacturer's name				Service Services Services	10		
- Type Model No feet to feet					7		
Diameter Slot size Set from feet to feet							
	942 ,	nt. i i	., 6"	and the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second of the second o	207 2		
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Surface seal? D Yes D No To what depth #6 feet Meterial used in seal D Cement grout D Puddling clay	1	13.4		्रमान्यम् व्यक्तः स्थानम् । व्यक्तिक्षः व्यक्तिः			
		-		The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s			
6. LOCATION OF WELL		Ì		en de la companya de la companya de la companya de la companya de la companya de la companya de la companya de	11:00		
Sketch map location must agree with written location.	10. W	ork star	rted <u>D</u>	FC 3 finished DEC 15			
	15 %	1711		第一十五十二 · 八 · · · · · · · · · · · · · · · · ·	W.Y. S		
W = = = =				RTIFICATION (1) It is a supervision and this report is	#		
				of my knowledge.	1		
		rect	-/^2	DRILL CONTRACTOR	3)		
25.8	, B	riller's O	Firm's	Number			
County 151 Bay	A	ddress	MAG	10000000000000000000000000000000000000	1		
X A CT 1/2 Sec. C. T. C. N/S, R. 4/1 E/W	, S	ड़िस igned By	• <del>7-</del>	The Date 14	A STA		

100010000	
	NGS AREA WELL INVENTORY FORM
1 45	
Well Number: Lewis Wel	11 Date: (0/3/93
Well Number: Lewis Well Other Well ID: Humble	Date: 6/3/93 Well Surveyor: Norton
Name of Well Owner: Deiv	in + Toni Humble
Well Location	
Owner's Address: 5	540 E 480 N 500a Springo ID 83-276
Street Address of Residentia	al Well Site if Different from Owner:
	LA
	1013
<u>-</u>	
Current Well Use: 310	ck, (irrigation eventually
Verification by Owner/Occupant of	Well Use: Jani Humble (signature)
Well Water in Contact with Humans	s: Yes No
Well Coordinates: Lat: System:	Long:
22	
Township 96 Range: L	42E Section (nearest 1/4 1/4:): 6 NE/4 of 5E/6
Well Specifications: Installation Date: 495 Well Construction Type:	(locia)
Well Specifications: Installation Date: 195	Total Depth (ft): 750 (05)
Well Specifications: Installation Date: Well Construction Type: Pump System Type:	(60a)  14 Total Depth (ft): 150 105  8" to 19", 7" to 35", +5" to 105"
Well Specifications: Installation Date: 195 Well Construction Type:	Total Depth (ft): 150 105
Well Specifications: Installation Date: Well Construction Type: Pump System Type:	(60a)  14 Total Depth (ft): 150 105  8" to 19", 7" to 35", +5" to 105"
Well Specifications: Installation Date: Well Construction Type: Pump System Type:	(60a)  14 Total Depth (ft): 150 105  8" to 19", 7" to 35", +5" to 105"
Well Specifications: Installation Date: 195 Well Construction Type: Pump System Type: Well Access for Sounding:	(60a)  14 Total Depth (ft): 150 105  8" to 19", 7" to 35", +5" to 105"
Well Specifications: Installation Date: 195 Well Construction Type: Pump System Type: Well Access for Sounding: Other Information: Photograph Taken: Well Log Available:	1
Well Specifications: Installation Date: 195 Well Construction Type: Pump System Type: Well Access for Sounding: Other Information: Photograph Taken: Well Log Available: Well Log Obtained:	Yes   Photo Number: 19   19   19   19   19   19   19   19
Well Specifications:  Installation Date:	Yes   Photo Number: 19   19   19   19   19   19   19   19
Well Specifications:  Installation Date:	No Yes Photo Number: 19 No Yes Photo Number: 19 No Yes No Yes No Yes Ward + house use Wall 15 10 Cated in Front
Well Specifications:  Installation Date:	No Yes Photo Number: 19 No Yes Photo Number: 19 No Yes No Yes No Yes Ward + house use Wall 15 10 Cated in Front

USE TYPEWRITER OR BALL POINT PEN

# Department of Water Administration

# WELL DRILLER'S REPORT

RECEIVED

State law requires that this report be filed with the Director, Department of Water Administration with 1802 C 1974

days after the completion of	-		D			
1. WELL OWNER		RLEVEL	₩S1e	it of Seator Research	es .	
Name LARRY Lewis			27 feet below land	surface		-
Address Sodd Springs, Id. 83276	Tempe	erature <u>4</u>	s IT No G.P.M. II 6°F. Quality <u>Go</u>	<i>o</i> d		-
Owner's Permit No.			pressurep.s.			
2. NATURE OF WORK	8. WELL	TEST DA	TA ·			
☐ New well ☐ Deepened ☐ Replacement	Ö Pur	mp	□ Bailer			
☐ Abandoned (Jescribe method of abandoning)		ge G.P.M.	Draw Down	Hours Pu	mped	$\exists$
						二
3. PROPOSED USE						
Domestic   trigation   Test   Other (specify type)		OLOGIC L	og		Wa	101
☐ Municipal ☐ Industrial ☐ Stock ☐ Waste Disposal or Injection	Hole Dism. Fro	Depth Im To	Material		Yes	No
4. METHOD DRILLED	12. 14 6		Nard Massi	Ve Lava	+-	产
r'	7 /B /	9 24	# 1/	1/	X	7
1 Cable	11 3		Red Cinder Hard Massiv	e Lova		X
5. WELL CONSTRUCTION	6 Y4 3	5 4/	Broken Lay		1	4
Diameter of hole 10 14 inches Total depth 165 feet	" 7		Hard Massil	e Lava		F
Casing schedule: Ø Steel	11 10	6 102	KRI LE		12	7
Thickness Diameter From To	" 70	703	7.87.8	<u></u>		
. 150 inches 7"I.P. inches 12 feet 35 feet . 157 inches 5"I.P. inches 37 feet 165 feet					╁╌	$\vdash$
inches feet feet						
inches inches feet feet					<del> </del>	┝╌┆
Was a packer or seal used?					二	
Perforated? \$\mathbb{B}\$ Yes \$\mathbb{D}\$ No How perforated? \$\mathbb{B}\$ Factory \$\mathbb{B}\$ Knife \$\mathbb{D}\$ Torch					┼	H
Size of perforation inches by Inches						
Number From To 246 perforations 85 feet 105 feet					士	
perforations feet feet					Ι	
perforations feet feet					<u> </u>	
Well screen installed?			·			
Type Model No feet to feet					$\vdash$	$\vdash$
Diameter Slot size Set from feet to feet					士	
Gravel packed? [] Yes [] No Size of gravel					+	<del>├</del> ─┤
Placed from feet to feet					二	
Surface seal depth / 9 Material used in seat					┽—	<del> </del> -!
Puddling clay Well cuttings  Seeling procedure used Starry pil Sameoutly surface cosing						
·	1		<u></u>		ــــــــــــــــــــــــــــــــــــــ	╙┈┤
Overbore to seed depth	J		_		<b>7</b> ✓	
6. LOCATION OF WELL	Work	started	7-28-74 finish	ned 8-/5-		i
Sketch map location must agree with written location			PIPECATION	-		!
	II. DRIL	LERS CER	rification <u>e Isan Dri/</u>	1/16 -	. و	, 15
Subdivision Norms	Firm	Name A	7	r / r vi Firm I	~ <u>~</u>	<u>-</u> -
Lot No Block No	Addr	••• <u>2 0 d 3</u>	3prid6> 101	Doto_0	73.	<u> </u>
	Signe		Official) Day Na	· lear-		_ '
County Carlboc			and erator)			_
NEUSEVEN / T 9 NED 42 EM	. I	•				

SODA SPR	UNGS AREA WELL INVENTORY FORM
	hool Well Date: 6/3/93  Surveyor: 4ates
Name of Well Owner:	y of Soda Springs
Well Location	V
Owner's Address:	95 Eart / fooper Are Soda Springs 20 83276
Street Address of Residen	tial Well Site if Different from Owner:
-	NA NA
- -	
Current Well Use: 11500 + head	for geothermal energy, cooling
Verification by Owner/Occupant of	of Well Use: Rubut B. Toggan (signature)
Well Water in Contact with Huma	uns: Yes No V
Well Coordinates: Lat: System:	Long:
Township 95 Range:	42E Section (nearest 1/4 1/4:): 7 NW/4 of NW/4  (7hh)
Well Specifications:  Installation Date:  Well Construction Type:	9832 Total Depth (ft): 800ff
Pump System Type:	no pump-artisian
Well Access for Sounding:	no
Other Information:	
Photograph Taken: Well Log Available: Well Log Obtained:	No Yes Photo Number: 22 No Yes No Yes Yes
Other: Q = 80 gpm	
<u>0-400</u> (	o" steel casing
400-800	4" Steel Casing
Well log available	e from Superintendent Rigby

78 ,

#### STATE OF IDAHO DEPARTMENT OF WATER RESOURCES

USE TYPEWRITER OR CALL TOINT PEN

WELL DRILLER'S REPORT State law requires that this report be filed with the Director, Department of Water Resources

Within 20 days after the completion or abandonment of the well. NOV 15 1982

1. WELL OWNER	7. WATER LEVEL Department of Water Resources Eastern District Office							
Name <u>Soda Springs School</u>		Static water level feet helow land surface.						
Address Soda Spr. inga Idaho83276		Flowing? All Yes LI No G.P.M. flow 116 Artesian closed in pressure 50 p.s.i.						_
Owner's Paimit No.	Controlled by: El Valve   Cap   Plug Temperature 78 °F. Quality Good							
2. NATURE OF WORK	8. WELL TEST DATA							
☑ New well ☐ Deeponed ☐ Replacement		D Pump D Bailer D Air D Oth						
Abandoned (describe method of abandoning)		Dischar	ge G.P.M		Pumping Level	Hours Pa	nuber	<del></del>
								_
D. PROPOSED USE	_							
□ Domestic □ Irrigation ፟	9	. LITH	IOLOGI	لـــــا د د د		·		
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection ☐ Other (specify type)		Hole Depth						ater
tapeatry types	Diam		To 6	RI	Material ack mud		Ye	s No
I. METHOD DRILLED		10	1.4	Sh	nle & clay			X
関 Rotary	B	148_	<u> 48.</u> 58.		rd gray basalt oken brown basalt		-   <u> </u> _X_	
		58 65	65_72_	Fi	rm brown basalt		<u> </u>	X
. WELL CONSTRUCTION		72_	77_	_F_:	ım gray basalt		Α.	X
Casing schedule: IX Steel		77_ 82_	90		own broken basalt nu brown basalt		X.	X
250 inches 8 inches + 1 feet 34 feet	-	90 <u> </u>	93 123		oken brown basalt		<u> </u>	X.
250 Inches 6 Inches 1 feet 269 feet 250 inches 1 feet 390 feet	.	123	128	Dr	oken & some clay		X	X
inches leet feet		128	155		d gray basalt ken gray basalt			XX
Was casing drive shoe used? IX Yes4! IN No & 8!! Was a packer or seal used? Yes IX No		1.55 1.59	159	Bro	own clay d gray basalt		_	X X
Perforated?		173	182	Bro	ken some clay		X	
Size of perforation inches by inches		182 221	221		d some clay			<u>X</u> X
Number From Tofeetfoet		225	241	Bro	wn clay & gravel		_	X.
perforations feet leet perforations feet leet		24.L. 252	252	F11 Bro	m white rock ken white rock		X	X.
Well screen installed? Yes C7 No	[	265_ 270_	270	_Fj_	m white rock			X
Manufacturer's name  Type Model No.  Diameter Slot size Set from feet to feet		275.	282	Bro	ken rock			Ŷ.
Diameter Slot size Set from feet to feet		282_	290   295	Tu£ Con	f red rock & clay		$\dashv$	XX
Gravel packed?  Yes  No  Size of gravel		295 305	305	Tut	rlomerate f red clay y & gravel			Ŷ
Piaced from feet to feet Surface seal depth 260 Material used in seal: XX Cement grout		310	310 331	Lay	ers of red clay &	conglome	rat	
☐ Puddling clay ☐ Well cuttings		331 394	394 405		e gummy clay ht gray rock firm			XX
Sealing procedure used: Sturry pit XX Temp, surface casing XX Overbore to seal depth		405	411	Bro	ken & clay (seepa,	ge water	X	_
Method of joining casing:   Threaded XX Welded   Solvent		4 <u>11</u> 433	436 436		m gray rock sand clay		<u>X</u>	$\overline{\mathbf{x}}$
Weld  Cemented between strate		4361	<b>760</b>	Bro	ken rock & clay	(OVER)		X
Describe access port Well Cap	10.	Worl	k started	<u>.</u>	5/10/82 finished _	8/17/82		
LOCATION OF WELL				-	FICATION			$\dashv$
Sketch map location must agree with written location.	• • • •				l minimum well construct	tion standard	s wer	re
N Subdivision Name	•	complie	ed with a	at the	time the rig was removed	•		ł
100	ı	Firm Na	ame <u>An</u>	dre	v Well Drillingfirm	No5		.
W	,	Address	126	8_E	Contr. . <u>17th Street</u> Date	8/24./5	2_	
Lot No Block No			Tda	lin 1	Outa odehi effe	77 /7		_
S		orgried i	by (Firn	i Ull and	on Dale H	ANCOLIC 1	<u>, w</u>	•
unty <u>Caribou</u>			(O)	perate	on Dale 14	fre		
tt. и MV. и Sec. 7, т9 _ м/s, п. 42 е/м.								_}

SODA SPRINGS AREA WELL INVENTORY FORM
Well Number: LISh Well Date: 6393 Other Well ID: Harviott Well Surveyor: 4ctes
Name of Well Owner: Jay Ush
Well Location
Owner's Address: 160 N. Hooper Auc Social Springs ID 83276
Street Address of Residential Well Site if Different from Owner:
- PA
Current Well Use: yard, stock no domestic use
Verification by Owner/Occupant of Well Use: (signature)
Well Water in Contact with Humans: Yes No
Well Coordinates: Lat: Long:
Township 95 Range: 42E Section (nearest 1/4 1/4:): 8 HW/4 of NW/4 (8bb)
Well Specifications:  Installation Date: 1968 Total Depth (ft): 40 Well Construction Type: Unknown
Pump System Type: Un Known
Well Access for Sounding: POSSIBLY with blad torch
Other Information:
Photograph Taken:  Well Log Available:  Well Log Obtained:  No  Yes  Photo Number:  Yes  Yes  Yes
Other: Stock use of well 15 for
horse boarding. Well is located
in ariveway near stables.

## REPORT OF WELL DRILLER

State of Idaho

Departure of the State Reclimation of the well. Engineer within 30 days after completion or abandonment of the well. WELL OWNER: Size of drilled hole: 6 inch Total depth of well: 40 Ft Standing water level below ground: 27 Temp. Fahr. 40 Test delivery: 20 Ralph J. Marriott Hame 760 E. Hooper Ave. Address or ____cfs Pump? ___ Bail _____ Size of pump and motor used to make test: Soua Springs, ID 83276 Owner's Permit No. NATURE OF WORK (check): Replacement well New well X Deepened Abandoned Length of time of test: 6 Hrs. Min. Drawdown: 4 ft. Artesian pressure: ft. Water is to be used for: water yard above land surface or gpm. Shutoff pressure:

Controlled by: Valve Cap Plug
No control Does well leak around casing?

Yes No X METHOD OF CONSTRUCTION: Rotary X Cable X ___Give flov___cfs Dug Duber_ (explain) CASING SCHEDULE: Threaded Welded "Diam. from_ 0 ft. to 14 ft. to "Diam. from MATERIAL WATER _ft. FROM TO "Diam. from_ YES OR NO _ft. to "Diam. from ft. FEET FEET It. to 14 Soft Lime Stone Thickness of casing:___ Material: no 14 40 Basalt Steel X concrete vood other ve s (explain) PERFORATED? Yes No X Type of perforator used: Size of perforations: " by perforations from It. to It. perforations from ft. to ft. perforations from ft. to ſt. Perforations from WAS SCREEN INSTALLED? Yes ft. to No 🗷 Manufacturer's name_ Model No. Diam. Slot size Set from ft. to ft. Diam. Slot size Set from ft. to ft. CONSTRUCTION: Well gravel packed? Yes No. K size of gravel Gravel
placed from ft. to ft. Surface seal
provided? Yes No To what depth?

1t. Material used in seal: Did any strata contain unusable water? Yes No. X Type of water:

Depth of strata ft. Hethod of sealing ft. Hethod of scaling strata off: Surface casing used? Yes x Cemented in place? Yes Locate well in section Work started: 6.15.68 Work finished: 6.28.68 Well Driller's Statement: This well was drilled under my supervision and this report is true to the best of my knowledge. Name: Carroll Hildreth Drilling Address: Soda Springs, ID Signed by: Carrell License No. // LOCATION OF WELL: County_ Caribou Date: July 6, 1968 NW X NW X Sec. 8 T. 9 WS R.42 E/V

Use other side for additional remarks

11

SODA SPRINGS AREA WELL INVENTORY FORM
65
Well Number: GIDSON Well Other Well ID: DA Surveyor: DOMON
Name of Well Owner: Val G1650n
Well Location
Owner's Address: 26 S 3rd Soda Springs ID 83276
Street Address of Residential Well Site if Different from Owner:
in field - no address
Current Well Use: irrigation - barrey field
Verification by Owner/Occupant of Well Use:
Verification by Owner/Occupant of Well Use: (signature)
,
Well Water in Contact with Humans: Yes No
Well Coordinates: Lat: M Long:
System:Long:
Township 95 Range: 42E Section (nearest 1/4 1/4:): 18
(18aa) NE14 of NE14
Well Specifications:
Installation Date: 1984 Total Depth (ft): 135
Well Construction Type: 0-90' Steel (asing
Pump System Type: $\frac{90-135}{Q} = 3000 gpm$
Well Access for Sounding: <u>Yes</u>
Other Information:
Photograph Taken: No Yes Photo Number: 15
Well Log Available: No Yes
Well Log Obtained: No Yes
Other: Improved + cased in 1980. Not sure
when drilled.
Well is 200' south of north boundary
in center of field. Val 6,1550 has concern
over water rights + doesn't want anyone gaing to his
well without letting him know.

#### STATE OF IDAHO DEPARTMENT OF WATER RESOURCES

USE TYPEWRITER OF BALLPOINT PEN

## WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

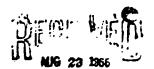
1. WELL OWNER	7.	WATE	R LEVI	EL				
1/4/ 6/1543		Static	water le	vel 3 1	feet below	w land surface.		
Name MAL GIGSON Address R# Bory 357 RANCE	Flowing? Tyes & No G.P.M. flow							
Address R# Borz 357 Chile	Artesian closed in pressure p.s.i. Controlled by:   Valve   Cap   Plug							
	TemperatureOF. Quality							
Owner's Permit No.		1611100						_
2. NATURE OF WORK	8.	WELL	TEST	DATA				
•		□ Pui	mo	Bailer	C) Air	□ Other		
New well □ Deepened □ Replacement     Abandoned (describe method of abandoning)						Hours Pu		
Additioned (describe metrics of the many)	<u> </u>	Discharge	G.P.M.		Pumping Level	Hours Pu	mpeu	_
								<u>.</u> .
a appropriate								
3. PROPOSED USE	<b> </b> -			l				
□ Domestic ß Irrigetion □ Test □ Municipal	9.	LITH	OLOGIC	CLOG			T :::	
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection ☐ Other (specify type)	Hole		-		Materia	al	Yes	
D VIIII	16°	From	20	272	ry LA	VA	1	ズ
4. METHOD DRILLED			,3°C	Broki	A Red LA	ALAT CIMY		X
☐ Rotary ☐ Air ☐ Hydraulic ☐ Reverse rotary	16"	30	32		- Rudha		<del> </del>	
Cable Dug Dother	160	32	50	CO).W	ca Kray	CAMY LHUM	定	
	16"	54	85	HAND	ALAY	LAUH	-1-5-	_
5. WELL CONSTRUCTION	1		130	ec.	1 (444)	LAUH + CIM	iH(	-
Casing schedule: 🖒 Steel 🛘 Concrete 🗖 Other	(5		140	nich	L WH Ter	100 1201		
Thickness Diameter From To 1921 inches 14 inches + 1 feet 75 feet	4		148	STICK	() Blown	CIHY	12	_
inches inches feet feet	11		7550	Some	310-2 C	(# <u>)</u>	+(	-
inches feet feet	<del></del>	747	739	17.00	0 2.40	<u>~</u>	力	
inches inches feet feet							₩	<b>-</b>
Was casing drive shoe used? ✓ Yes □ No Was a packer or seal used? ✓ Yes □ No		<del> </del>	<del>  </del>				+{	<del> -</del>
Perforated?		<del>                                     </del>					工	
How perforated? ☐ Factory ☐ Knife 🗵 Torch							++	<u> </u>
Size of perioration inches by inches	1						+-	-
2 / perforations 50 feet 75 feet		<del> </del>	<del>  </del>					
perforations feet feet feet feet feet							┼	-
Well screen installed?  Yes  No		<del> </del>	┼				+-	-
Manufacturer's name		ļ					$\Box$	
Type Model No.		ļ					<del> </del>	╀
Diameter Slot size Set from feet to feet Diameter Slot size Set from feet to feet		<del> </del>	┼┤				1-	<del>  -</del>
Gravel packed?   Yes No Size of gravel							Τ.	
Placed fromfeet tofeet Surface seal depth	1						-	-
☐ Puddling clay ☑ Well cuttings	`		<del>                                     </del>					
Sealing procedure used: Slurry pit Temp. surface casing								·
Æ Overbore to seal depth  Method of joining casing: □ Threaded ☒ Welded □ Solvent	ʻl—		<del>  </del>			<del></del>	+	•
Weld		-					工	
Describe access port	10							
Describe access port	"	We	ork start	ted 5	3/84 fin	nished 5/22	18	K
	<del> </del>							
6. LOCATION OF WELL	11			CERTIFIC		construction stand	orite w	oro
Sketch map location must agree with written location.	l	1/We	certity	that all fi h at the ti	me the rig was f	removed.	p. U. W	CIE
Subdivision Name						: •	, _	
	1	Firm	Name	AUL FI	Hndsients	Firm No. <u>3</u> جهو	- 0	
W = E		Addr	ess Bc	7637	LALA	Date <u>5/2</u>	3/	44
Lot No Block No	1					' -		
		Signe			al) Jan			
County CAGIBUU	1			and	01	Zan Os	<b>.</b>	
			(	(Operator)	y and	والمتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتعمل المتع		
NL x 10-15 x Sec. /6 , T. / 11/5, n. /2 FAM:			inginerate.	-		KINGENPINTA NASES COM	-	

#### WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER	7. WATER LEVEL							
Name Larry Hildreth		Static	: water	level 23 feet be	alow land surface.			
Address 261 S, 3 E, Soda Springs, Idaho		Flowin Artesi Contr	ng? Lian clos	☐ Yes 配 No G.P. sed-in pressure	P.M. flow p.s.i. pPlug			
Owner's Permit No.				oy: U valve 22 Cap 2 43 OF. Quality				
2. NATURE OF WORK	8.	WELI	TEST	DATA	<del></del>			
New well Deepened Replacement Abandoned (describe method of abandoning)		□ Pu	mp	□ Bailer 10 Air	Other			
☐ Abandoned (describe method of abandoning)		Discharge		I. Pumping Levi	el Hours Pu	ımped		
			<u>~</u> _					
3. PROPOSED USE							_	
Domestic □ Irrigation □ Test □ Municipal	9.	9. LITHOLOGIC LOG						
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection ☐ Other (specify type)	Hole			Mate	• A	_	ater	
U Utner toponty specific	Diam.	. From	To 19	ividio	erial ·	Ye	s No	
4. METHOD DRILLED	340	0	4	lava & sand w/	clay layers	+_	x	
	"	12.	19	hard lava		工	x	
☑ Rotary ☑ Air ☐ Hydraulic ☐ Reverse rotary ☐ Cable ☐ Dug ☐ Other	6	19	23_	11 11		]_	x	
D capie D bog	6	23_	32_	medium hard. p	orous lava (c	1 pmp	<u>, p</u>	
5. WELL CONSTRUCTION	6_	32 34	34	fractured lava	Heuser	PE.	X	
	5		45	II II some	softer 42to43	i se	EŁ	
Casing schedule:  Steel  Concrete  Other Thickness  inch Diameter 6" I.D. From +1 ft To 19						I_	<u> </u>	
inches inches + feet feet		!		T.D. 45 fee	t	┼	┼	
inches feet feet			<del> </del>	<del></del>		+	+-	
inches feet feet	<b></b>	1		<u> </u>		士	<u>t_</u>	
inches feet feet							二	
. Was casing drive shoe used? ☐ Yes 恐 No		<b>_</b>	ļ			]	1	
Was a packer or seal used? ☐ Yes	<b> </b>		<b> </b>	ļ <del></del>		+	₩	
How perforated?  Factory  Knife  Torch						┼─	+-	
Size of perforation inches by inches				<del></del>		+	+	
Number From To						士	匸	
perforations feet feet							匚	
perforations feet feet feet feet		ا۔۔۔ا	11			<del>-</del>	1	
Well screen installed?  Yes  No		<del>  </del>	<del>  </del>			┼	┼	
Manufacturer's name		<del> }</del>	<del></del>			+-	+-	
Type Model No	<u> </u>					<u> </u>	<u>†_</u>	
Diameter Slot size Set from feet to feet						二		
Diameter Slot size Set from feet to feet Gravel packed? □ Yes ☑ No □ Size of gravel		11	i			<u></u>	<u> </u>	
Placed from feet to feet		<b>/</b>	<del></del>		<del></del>	<del> </del>	┼	
Surface seal depth 19' Material used in seal: 12 Cement grout	<del>  </del>	<del></del>	ı <del> </del>			+	+-	
□ Puddling clay     □ Well cuttings	1-1	,				+_	+-	
Sealing procedure used: Slurry pit Temp. surface casing							二	
Method of joining casing: □ Threaded □ Welded □ Solvent	<u> </u>		1			<del> </del>	1_	
Weld Welded		ı——	,			┼—	┼	
☐ Cemented between strata	<del></del>			· · · · · · · · · · · · · · · · · · ·		ــــــــــــــــــــــــــــــــــــــ	ــــــ	
Describe access port	10.	**1-		led 6 / 10 /83 fi	6/11 <i>/</i> 5	22		
	I	Wor	/k staru	led 0 / 10 / 0	nished	<u>''</u>		
6. LOCATION OF WELL	11	2011	· ERS	CERTIFICATION				
	i				aslan etanda		~~~	
Sketch map location must agree with written location.  N	i		•	that all minimum well in the the time the rig was		(05 vr.	ere.	
Subdivision Name SV corner blod	k			•				
7-01-02-by	i .	Firm N	√ame_V	V.A.L.L. Drillin	g_ Firm No386	<u>;                                    </u>		
w =								
				. Box225, Grace				
Lot No Block No	i	**	· · · · · /F!	irm Official) Ale	1/			
	i	Signed	bγ (·	rm Utiliciais	- Hanne		-	
County Carribou	i		,	and Operator) A-f	1/_			
	ı		. (1	Operator) _7-[	MEnas		-	
NW 1/2 NE 1/2 Sec. 18 T. 9 N/S, R. 42 E/W.	ı				•			

SODA SPRINGS AREA WELL INVENTORY FORM
68 Steeles Well
Other Well ID: Date: 44  Other Well ID: DA  Date: 44  Surveyor: 465
Name of Well Owner: Stanford Steele
Well Location
Owner's Address: 700 5 3rd E  5009 Springs ID 83276
Street Address of Residential Well Site if Different from Owner:
- Same
Current Well Use: domestic, little stock, yard
Verification by Owner/Occupant of Well Use:
Well Water in Contact with Humans: Yes No
Well Coordinates: Lat: Long:
Long:
System: Long:
System:  Township 95 Range: 42E Section (nearest 1/4 1/4:): 18 5E 1/4 of NW (18 bd)  Well Specifications:  Installation Date: 966 Total Depth (fi): \$\frac{1}{2}\$
System:  Township 95 Range: 42E Section (nearest 1/4 1/4:): 18 5E 1/4 of NW (18 bd)  Well Specifications:  Installation Date: 966 Total Depth (fi): 12 12 12 12 12 12 12 12 12 12 12 12 12
System:  Township 95 Range: 42E Section (nearest 1/4 1/4:): 18 5E/4 of NW (18 bd)  Well Specifications:  Installation Date: 966 Total Depth (fi): 10 10 10 10 10 10 10 10 10 10 10 10 10
System:  Township 95 Range: 42E Section (nearest 1/4 1/4:): 185E/4 of NW (1860)  Well Specifications: Installation Date: 966 Total Depth (fi): 12 12 1
System:  Township 95 Range: 42E Section (nearest 1/4 1/4:): 18 5E/4 of NW (18 bd)  Well Specifications:  Installation Date: 966 Total Depth (fi): 10 10 10 10 10 10 10 10 10 10 10 10 10
System:  Township 95 Range: 42 E Section (nearest 1/4 1/4:): 18 5E 1/4 of NW 1/8  Well Specifications: Installation Date: 966 Total Depth (fi): 10 1  Well Construction Type: 6 Steel Casing  Pump System Type: 1691  Well Access for Sounding: 100  Other Information:  Photograph Taken: No Yes Photo Number: 1691  Well Log Available: No Yes Photo Number: 1691
System:  Fownship 95 Range: 42 E Section (nearest 1/4 1/4:): 18 5E 1/4 of NW 1/6  Well Specifications:  Installation Date: 96 Total Depth (fi): 10 1/2  Well Construction Type: 6" Steri Casing  Pump System Type: 169  Well Access for Sounding: 100  Other Information:  Photograph Taken: No Yes Photo Number: 40  Well Log Available: No Yes (Forgot Camera)  Other:
System:  Fownship 95 Range: 42 E Section (nearest 1/4 1/4:): 18 5E 1/4 of NW 1/6  Well Specifications:  Installation Date: 96 Total Depth (fi): 10 1/2  Well Construction Type: 6 Steel Casing  Pump System Type: 16 1/4  Well Access for Sounding: 100  Other Information:  Photograph Taken: No Yes Photo Number: 40 1/4  Well Log Available: No Yes (Forgot Camera)  Other:



#### REFORT OF WELL DRILLER State of Idaho

C

Department of Recommission that this report shall be filed with the State Reclamation State law requirement that the report shall be filed with the State Reclamation Engineer within 30 days after completion or abandonment of the well...

THE HEAL ALTHUM TO GRAD GIANT CONTINUES OF				ļ
WELL OWNER:	Size of	f dr	illed hole: al le Total rell: 4 Standing water w ground: Temp. Test delivery: 50 ofs Pump?   Dail   Air	į
Want of a second	depth o	of w	mell: 40cm Standing water	1
Name Stanford Steel	level 1	belo	w ground: Temp.	1
Address Soda Springs, Idaho	Fahr		Test delivery: so	pm
	O7		ofs Pump?   Bail   Air	
Owner's Permit No.	Size o	f pu	mp and motor used to make test	; 1
	l			
New well Deepened Abandoned	Length	30	time of test: Hrs. H	-n
		_	TO APERSIAN DESERVES 11	
Vater is to be used for: Demostie	SPOA6	land	THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE S	• 1
METHOD OF CONSTRUCTION: Rotary Cable	OT	_gp	a. Shutoff pressure:  a. Shutoff pressure:  by: Valve	
Dug Other	Contro	1100	d by: Valve L Cap Plus	<u> </u>
CASING SCHEDULE: Threaded Velded Tolam. from If to GI ft.  "Diam. from ft. to ft.  "Diam. from ft. to ft.	No con	tro	J Does Astr resk stoned can	Brug.
CASING SCHEDULE: Threaded Velded z	Yes	<u>ו</u>	No MATERIAL WES	.===
Wiam. from -I ft. to 61 ft.	DEP	TH	MATERIAL W.	ATER TO
"Diam. from ft. toft.	FROM	10	150	OK NO
"Disa, from ft. to ft.	FEET F	EET		
	10	• ]	DIFE	}
Thickness of casing: 10 Haterial:	4	**	Fe AF	i
Steel concrete wood other	40	*	ATLEC MCCOL ASS	
Steel . couciete . acce . acce.	1-88-18	2	LEVE BY HE COL	
Bottom of hole gravel peak ed. Computed col	1 e -	<u> </u>	700	
at 40521 West filled with rock dust.	<b> </b>		Great with mid yes	
PERFORATED? Yes   No   Type of	64_17	7	LAYE OF WILDE	eene
perforator used: Torch out,				<del></del> !
	╺├╼╼┿			
Size of perforations: 3/18 x 4 h by 40 h perforations from 68 ft. to 72 ft.  perforations from ft. to ft.  perforations from ft. to ft.	<del>  -</del>			
perforations from				
perforations fromit.	-			
perforations fromit.				
perforations fromft. toft. perforations fromft. toft. WAS SCREEN INSTALLED? Yes No	<del> </del>			i
WAS SCREEN INSTALLED? 108	<del> </del>			
Manufacturer's name	-			
Manufacturer's name  Type	<del>.</del>		<del></del>	
Diam. Slot Bird Set Iron 11. to 1	[]			
DIAM. SION BIRE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF THE SENTENCE OF TH	<u>`</u>			
CONSTRUCTION: Well gravel packed? Yes				
No. Line of gravel Gravel				<u> </u>
No.   sixe of gravel Gravel placed from 60 ft. to 72 ft. Surface seal				<b></b> _
PROAIGOU. IER (*) MO ; I TA ANGE GARAN.				<u> </u>
ft. Material used in seal: Outtines	-			<b></b>
	$\neg \Box$			<u> </u>
Did any strata contain unusable water? Yes Ro. Type of water: Good Depth of strata ft. Method of seali	<b>-</b>			<u> </u>
No. Type of water:				<b></b> _
Depth of stratait. Hethod of Beats	" 9			
strata cff:	-			
	-	<b>—</b>		<del> </del>
Surface casing used? Yes No. R	<del>-</del>		<del>                               </del>	<del> </del> -
Cemented in place? Yes   No				<del> </del>
	ļ			+
Locate well in section		├		<del></del>
		├		+
	<u> </u>	├		<del>                                     </del>
	Work	81.0	rted: 3, 1966	<del> </del>
	Work	fir	ished by	1
	Well	Ded	ller's Statement! This well wa	
Sec			under my supervision and this	
	140 **		to the hest of my knowledge.	
	Name	Īv	n Borts	
	i i			
	Addr	ess:	Orace, Idaho	<del></del>
	31 gn	ed 1	y: Im Bore (7) 140 275 11 Be	エノ
	Lice	nse	No. 51 Date: 122	966
LOCATION OF WELL: County				<del></del>
A MAN SUM OF THE MASS D. T. P./M.	-			
S/8 E/S > Sec. IR T. 0 4/3 R.42 E/4/				

Use other side for additional remarks

Cherry

soda springs area well inventory form
Well Number: Steele M Well Other Well ID: DAT Surveyor: 41493 Surveyor: 4665
Name of Well Owner: Mark Stelle
Well Location
Owner's Address: 780 S. 3rd East 5009. Springs ID 83276
Street Address of Residential Well Site if Different from Owner:
- same
Current Well Use: clomestic, some yard
Verification by Owner/Occupant of Well Use: Loudy Keeke (signature)
Well Water in Contact with Humans: Yes No
Well Coordinates: Lat: Long:
Township 95 Range: 4JE Section (nearest 1/4 1/4:): 18 SE/4 NW //
Well Specifications:  Installation Date: 1975  Well Construction Type: 5" Steel Casing (galvanized) pipe  Pump System Type: 4" aump 3/4 mater. 0400 ct 901
Pump System Type: 4" pump, 3/4 motor, pump at 90' Well Access for Sounding: 465
on receive for somitting.
Other Information:
Photograph Taken: No Yes Photo Number:
hale is down to 75'
SWL = 44' bgs (1975). Well is
located in back yard. No well house.

USE TYPEWRITER OR BALL POINT PEN

#### State of Idaho Department of Water Resources

### WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

	7. W.A	TERL	EVEL	•			1	
1. WELL OWNER					_			
Name Mark Steele	Static water level 44 feet below land surface Flowing? D Yes 10 No G.P.M. flow							
GOO BIOLK SOUTH 36 FAST	Temperature 47 ° F. Quality Good							
Address 5002 Sprides, Idaho 83276	Ar	mperat tesian c	losed-in	pressurep.s.i.				
	Controlled by 🗆 Valve 🗀 Cap 🗆 Plug							
Owner's Permit No.								
2. NATURE OF WORK	8. WE	ELL TE	ST DAT	ΓA			ĺ	
Z. WATONE OF MONTH	_	_		D Roller D Other			- }	
X New well Deepened Replacement	Disphares G.P.M. Draw Down Hours Pumped							
	Discharge G.P.M. Draw Dawn Hours vom: 2 0 44 25 47 1/2							
☐ Abandoned (describe method of abandoning)								
					<del> </del>			
	1			<u></u>	<u> </u>			
3. PROPOSED USE	ł						ł	
Domestic   trigation   Test   Other (specify type)	9. L	ITHOL	OGIC L	OG _				
The same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the sa	Hole		Yes					
☐ Municipal ☐ Industrial ☐ Stock ☐ Waste Disposal or Injection	Diam. From To				Material			
	124	0	6	overburden		7		
4. METHOD DRILLED	12	6	/8	Hand marrie	11	+	5	
□ Cable 62 Rotory □ Dug □ Other	63/4	18	37	Sand + line,	Clay		X	
□ Cable   □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □ Cable  □	<del>  "  </del>	46	54	Hand Marrial			×	
5. WELL CONSTRUCTION	"	54	_	11 broken	n	Y	$\vdash$	
	"	64	76	Medium Cremie		<u>Y</u>	-	
Diameter of hole 63/4 inches Total depth 108 feet	1 2	76	104	Hard Marine	· 11	+;	┼┤	
Casing schedule: Steel U Concrete	4 /4	104	108	" "	:	1-		
Thickness Diameter From To								
2 5% inches 5 I.D. inches + / feet 104 leet	1					4-		
inchesfeetfeet	1						<del> </del> -	
inches leet leet leet	1		L		<del>3</del>		╂┤	
inches inches feet feet  Was casing drive shoe used?	`			17:30 - 12	<del>  </del>	+-	╁╾┤	
Was a packer or seal used?			<del>                                     </del>	<del>l()</del>	<del>!}</del>			
Perforated? ☑ Yes □ No	NOV 18 1975							
How perforated?   Factory   Knife   Torch							1_	
Size of perforation 5/14 inches by 3 inches				Department of Water Remon	183		<del> </del>	
Number From To  504 perforations 62 feet /04 feet	,	ļ	<del> </del>	Eastern District Tition			+	
perforations feet feet		<del> </del>	<del> </del>			1	$\Box$	
perforations feet feet	,	1	1					
							<del> </del>	
Well screen installed? ☐ Yes 🖸 No							<del> </del>	
Manufacturer's name Model No	<u></u>	<del> </del>		<del> </del>		+	+	
Diameter Slot size Set fromfeet tofeet	ī <del> </del>	+	+			工		
Diameter Slot size Set from feet to fee	1					$\bot$		
							+	
Gravel packed?  Yes  No Size of gravel	<del>.</del>			<del>                                     </del>		<del>- </del>	<del> </del>	
Placed fromfeet tofeet		<del> </del>	+	<del> </del>		_		
Surface seal depth Material used in seal   C   Cement grou		+	1					
Puddling clay Well cutting							<del>  </del>	
Sealing procedure used Starry pit 12 Temporery surface cosine	4	<u> </u>	<u> </u>	<u> </u>			إـــــــــــــــــــــــــــــــــــــ	
☑ Overbore to seel dept	n e						ł	
	10.			1/- 1- 75 1000	11-16	-75		
6. LOCATION OF WELL	L	Nork st	arted	//- / - 75 finishe				
Sketch map location must agree with written location.		-					1	
	- 11.	DRILLE	RS CER	TIFICATION	20		1	
	1	Firm M	iame/	Nelson out	King Firm	Na.Z	15	
Subdivision Name								
W E Brook No.		Address	BXJ	44 Sada Springs,		10	<u> </u>	
Lot No Block No	1	Cime - J	bu 154-	Official) R. Nel				
		Signed	nl (Lau	and /	.1			
County C2+160V	_		<b>~</b>	perotor) N. Net	2		_	
			101	A 4 4 1 4 1 4 1 1 1 1 1 1 1 1 1 1 1 1 1				
S.E. 1/2 NIV 1/2 Sec. 18. T. 7 #15, R. 42 EA	A2.							

	RINGS AREA WELL INVENTORY FORM
72	NelsonD (aeep)
Well Number: Delson	1 Date: 6/3/93
Other Well ID:	Surveyor: Norton + Yetes
Name of Well Owner: Ra	·
Well Location	
Owner's Address:	960 E. 24'N. Seda Spindes, Fd. 83276
	Sida Spindes, Td. 83276
	ential Well Site if Different from Owner:
	same
-	
Current Well Use:	nking, domestic
	J,
	0 , 1
Verification by Owner/Occupant	of Well Use: (gignature)
	(signature)
Well Water in Contact with Hum	nans: Yes No
Well Coordinates: Lat:	
System:	
Township 95 Range:	: 42E Section (nearest 1/4 1/4:): 8 NE/4 of WW/4 (8ba)
Well Specifications:	oy -
Installation Date:	- 42 1/20 -
Well Construction Type:	991 1993 Total Depth (ft): 545
Well Construction Type:	
Well Construction Type:  Pump System Type:	
	6" Steel
Pump System Type:	6" Steel
Pump System Type:	6" Steel
Pump System Type:  Well Access for Sounding  Other Information:	G" Steel  G" Steel
Pump System Type:  Well Access for Sounding	6" Steel
Pump System Type:  Well Access for Sounding  Other Information:  Photograph Taken: Well Log Available:	G" Steel  G" Steel
Pump System Type:  Well Access for Sounding  Other Information:  Photograph Taken: Well Log Available: Well Log Obtained:  Other:  2 = 75   100	No Yes Photo Number: 24  No Yes No Yes No Yes No Yes
Pump System Type:  Well Access for Sounding  Other Information:  Photograph Taken: Well Log Available: Well Log Obtained:  Other:  D = 75 bq	No Yes Photo Number: 24 No Yes No Yes No Yes No Yes Seel - he may Start Using
Pump System Type:  Well Access for Sounding  Other Information:  Photograph Taken: Well Log Available: Well Log Obtained:  Other: Z = 75 bq  Tastes like ( Nelson 2 well for	No Yes Photo Number: 24  No Yes Photo Number: 24  No Yes  No Yes  So diesel - he may start using  or house use instead, well
Pump System Type:  Well Access for Sounding  Other Information:  Photograph Taken: Well Log Available: Well Log Obtained:  Other: Z = 75 bq  Tastes like ( Nelson 2 well for	No Yes Photo Number: 24 No Yes Photo Number: 24 No Yes No Yes Seel - he may Start Using

## STATE UF IDAHO DEPARTMENT OF WATER RESOURCES

USE TYPEWRITER OR BALLPOINT PEN

## WELL DRILLER'S REPORT

Du.

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

						_		
1. WELL OWNER	7. WATER	LEVEL	••			ı		
Name RAY Nelson	50 ()							
Name	Static water level 50 feet below land surface.  Flowing?  Yes SNO G.P.M. flow							
Address 1083 HW 34, Soda Springs, Id.						-		
Drilling Permit No. 11 - 91E - 015 83274	Artesian closed-in pressure p.s.i. Controlled by:							
Water Right Permit No.	Temperature 49 of Quality Good							
VValor right remit No.	Describe artesian or temperature zones below							
2. NATURE OF WORK	8. WELL TEST DATA							
_ '	□ Pump □ Bailer □ St. Air □ Other							
St. New well Deepened Replacement  Deepened Replacement	D Pump D Baller & Air D Other							
☐ Abandoned (describe abandonment procedures such as	Discharge G.P.M. Pumping Level Hours P							
materials, plug depths, etc. in lithologic log)	200 520 4							
3. PROPOSED USE								
				<u> </u>		ᅥ		
S Domestic	9. LITHO	LOGIC LO	OG					
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection	Bore Dept				Wate			
Other (specify type)	Diam. From		Material		Yes	No		
4 METHOD DOUGED		1817	ormation Ro	ch_	┢═┪	늯		
4. METHOD DRILLED	7 1/8		land lava (b	when	×	ᅱ		
© Rotary © Air ☐ Hydraulic ☐ Reverse rotary	1 45		Rand marrine			$\mathbf{x}$		
□ Cable □ Dug □ Other	75	8/ C	inders			abla		
	<del></del>	145 -	hand lawa		┝─┤	41		
5. WELL CONSTRUCTION	145	174	broken law	<u> </u>	<del>  </del>	-{-		
Casing schedule: 💢 Steel 🔲 Concrete 🗇 Other	120		Hed: lana	<u> </u>	X	-		
Thickness Diameter From To	160		" broken	lava		X		
1.50 inches 6 inches + / feet 1.0 feet	310		Sinder			$\angle$		
, 2 50 inches / inches / feet / 74 feet			Med. Lawa		-	41		
inches inches feet feet inches inches feet feet	320	380	Hard nama			4-1		
Was casing drive shoe used?   Yes  No	380		Med broken	Lave-		-		
Was a packer or seal used?	409	7/7 C	rafen lime	tone				
Perforated? ☐ Yes □ S No	418		Brn. Mard.					
How perforated? ☐ Factory ☐ Knife ☐ Torch ☐ Gun	445	455 V	de ash			$\Box$		
Size of perforation inches by Inches	1755	485 Ve	le. ash + Mand	seame	<u> </u>	$\sqcup$		
Number From To			ractured desom		U			
perforations feet feet	320	372	120 0 520-525	1 00 G PA	-			
perforations feet feet			7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 -					
Well screen installed? ☐ Yes ☐ No								
Manufacturer's name Model No				MD ENTER	ļ!			
Type Model No	1			<del>                                      </del>		-		
Diameter Slot size Set from feet to feet				<del>-                                    </del>	<del>                                     </del>			
Gravel packed? ☐ Yes Ø No ☐ Size of gravel								
Placed from feet to feet			APR 2 1	1992				
Surface seal depth <u>1.0</u> Material used in seal: Cement grout				in Decoupont	├			
Sealing procedure used: Sealing procedure used: Slurry pit (2) 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	<del>                                     </del>	<del></del>	Department of Wa		<del> </del>	$\vdash$		
Sealing processic account to seal depth	<del></del>		Edition Com-		<del>                                     </del>			
Method of joining casing: 🛛 Threaded 🎏 Welded 🚨 Solvent								
Weld					<u> </u>	Щ		
Describe access port PluG IN CAP	10.							
Describe access port	Wor	rk started	1-20-92 finished	d <u>2-3-</u>	92	_		
	<del> </del>					_		
6. LOCATION OF WELL	1		RTIFICATION			İ		
Sketch map location <u>must</u> agree with written location.	1/We d	certify the	t all minimum well const	ruction standa	rds w	ere		
N			the time the rig was remo					
Subdivision Name	_	/	elson	No. 2	15	ļ		
<del> </del>	1							
WE	Addres	" Sode	Spring Id.	Date 4-3-	92	-		
Lot No Block No	ł					_		
LOT ING BIOCK ING.	Signed	by (Firm	Official) Ray Na	lson		_		
S								
County C2+1600		(Ope	erator) 44/400 /	5/	>	_		
NE V NW V Sec. 8 T. 9 SBR. 42 WD			7					

SODA SPRINGS AREA WELL INVENTORY FORM  13 Nelson S (Shallow)
Well Number: Delson 2 Other Well ID: NA Date: 6/3/93 Surveyor: Wates + NOADA
Name of Well Owner: Ray Delson
Well Location
Owner's Address: 960 E. 2nd NoAh Soda Springp ID 83276
Street Address of Residential Well Site if Different from Owner:
Same
Current Well Use: domestic use (shop use & drinking in the shop.
Verification by Owner/Occupant of Well Use:  (signature)
Well Water in Contact with Humans: Yes No
Well Coordinates: Lat: Long: System:
Township 95 Range: 42€ Section (nearest 1/4 1/4:); 8NE 1/4 of Nω 1/4 (8 ba)
Well Specifications:  Installation Date: 1991 Total Depth (ft): 40  Well Construction Type: 511 Stell
Pump System Type:
Well Access for Sounding:
Other Information:
Photograph Taken: Well Log Available: Well Log Obtained:  No Yes Yes Yes Yes Other:  Other:  Photograph Taken: No Yes Photo Number: 23
()Phase
Los I
bethroom of shop office.

SODA SPRINGS AREA WELL INVENTORY FORM
Well Number: Brown Well Other Well ID: NA Surveyor: Porton
Name of Well Owner: William Brown
Well Location
Owner's Address: 145 N Hoopen - 24/15 Allen - Soda Springo ID 83276
Street Address of Residential Well Site if Different from Owner:
911 Pioneur - well site Soda Springs ID
Current Well Use: Dosnes Fre - clothes washing, c Dosnet drink it Dosne city water
Verification by Owner/Occupant of Well Use: (signature)
Well Water in Contact with Humans: Yes No
Well Coordinates: Lat: Long:
Township 95 Range: 40E Section (nearest 1/4 1/4:); 8 NE 1/4 of
System:
System:  Township 95 Range: 40E Section (nearest 1/4 1/4:): 8 NE1/4 of (8 ba) NW M/4  Well Specifications: Installation Date: about 82  Total Depth (ft): 125 A
System:  Township 95 Range: 40E Section (nearest 1/4 1/4:): 8 NE 1/4 of (8 ba) NW MM 1/4  Well Specifications: Installation Date: about 82 Total Depth (ft): 135 A Well Construction Type: 6" skeet
System:  Township 95 Range: 40E Section (nearest 1/4 1/4:): 8 NE1/4 of (8 ba) NW MW 1/4  Well Specifications:  Installation Date: about 82 Well Construction Type: 6" steel  Pump System Type: Submuse, the 3 Go gallon
System:  Township 95 Range: 43E Section (nearest 1/4 1/4:): 8 NE 1/4 of (8 ba) NW 100 1/4  Well Specifications: Installation Date: 4/2 Total Depth (ft): 135 ft  Well Construction Type: 6" sfee!  Pump System Type: 50 fmers, 26 3 (60 gallom)  Well Access for Sounding: 40 possibly W (wench)  Other Information:  Photograph Taken: No Yes Photo Number: 10 Well Log Available: No Yes  Well Log Obtained: No Yes
System:  Township 95 Range: 42 Section (nearest 1/4 1/4:); 8 NE'/4 of (8 ba) NW MB /4  Well Specifications: Installation Date: also + 82 Total Depth (ft): 135 A Well Construction Type: 6" Stee!  Pump System Type: Submise Le > (60 gallon)  Well Access for Sounding: AC POSIDIA W/ WENCH  Other Information:  Photograph Taken: No Yes Photo Number: 10 Well Log Available: No Yes Well Log Obtained: No Yes Other: fake Sample B. Geddes Okayed it even though
System:  Township 95 Range: 40 E Section (nearest 1/4 1/4:): 8 NE 1/4 of (8 ba) NW 888 1/4  Well Specifications:  Installation Date: about 82 Total Depth (ft): 135 ft  Well Construction Type: 6" steel  Pump System Type: Submuse ble > (60 gallorn  Well Access for Sounding: 40 proof Dly W (wench)  Other Information:  Photograph Taken: No Yes Photo Number: Well Log Available: No Yes  Well Log Obtained: No Yes  Other: fake Sample B. Geddes Okayed it even though  well is askully out side the skely area. Well 10
System:  Township 95 Range: 4DE Section (nearest 1/4 1/4:): 8 NE'/4 of (8 ba) NW MB 1/4  Well Specifications: Installation Date: a yout 82 Total Depth (ft): 135 At Well Construction Type: 6" Stee!  Pump System Type: Submine the a long allow  Well Access for Sounding: AD POSI DIY W/ WENCH  Other Information:  Photograph Taken: No Yes Photo Number: 10  Well Log Available: 1 No Yes  Well Log Obtained: 1 No Yes  Well Log Obtained: 1 No Yes  Other: fake Sample B. Geddes Okayed A even though  well is askally outsile the skely our Well 15  OCCATED IN YACO TO THE POST COST SIDE OF
System:  Township 95 Range: 40 E Section (nearest 1/4 1/4:): 8 NE 1/4 of (8 ba) NW 888 1/4  Well Specifications:  Installation Date: about 82 Total Depth (ft): 135 ft  Well Construction Type: 6" steel  Pump System Type: Submuse ble > (60 gallorn  Well Access for Sounding: 40 proof Dly W (wench)  Other Information:  Photograph Taken: No Yes Photo Number: Well Log Available: No Yes  Well Log Obtained: No Yes  Other: fake Sample B. Geddes Okayed it even though  well is askully out side the skely area. Well 10

SODA SPRINGS AREA WELL INVENTORY FORM
Well Number: Dinn Well  Other Well ID: Date: Doctor
Name of Well Owner: Alvin Dunn
Well Location
Owner's Address: 750 Big Sorings Rd Soda Springs ID 83276
Street Address of Residential Well Site if Different from Owner:
same
Current Well Use: Domes fix
Verification by Owner/Occupant of Well Use: (signature)
Well Water in Contact with Humans: Yes No
Well Coordinates: Lat: Long: Long:
Township 95 Range: 41E Section (nearest 1/4 1/4:); 13 NE'/4 of NE'/4
Well Specifications:  Installation Date: 1978 Total Depth (ft): 90 ft  Well Construction Type: 90 ft days 6" Casas
Pump System Type: Submissible
Well Access for Sounding: possibly - new Wrench
Other Information:
Other Information:  Photograph Taken: Well Log Available: No Yes Photo Number: 20 Well Log Available: Yes
Other Information:  Photograph Taken: Well Log Available: Well Log Obtained:  No Yes Photo Number:  Yes Well Log Obtained:  No Yes
Other Information:  Photograph Taken: Well Log Available: Well Log Obtained: No Yes Well Log Obtained: No Yes Other: What I a start Alfa fuld possibly watered

SODA SPRINGS AREA WELL INVENTORY FORM N Well Number: Nell Well Other Well ID: Clinton Name of Well Owner: Well Location Owner's Address: Street Address of Residential Well Site if Different from Owner. rinking Current Well Use: Verification by Owner/Occupant of Well Use: (signature) Well Water in Contact with Humans: No Well Coordinates: Lat: _ Long: System: Township 95 Range: 42E Section (nearest 1/4 1/4:): 8 NW 1/4 of 5w/4 (8cb) Well Specifications: Installation Date: Total Depth (ft): ____58 ff Well Construction Type: Pump System Type: ho motor -Well Access for Sounding: Other Information: Photograph Taken: No Photo Number: 25 Well Log Available: Well Log Obtained: years their well below top of well Well localed Surface

# APPENDIX H-6 GROUNDWATER ELEVATION DATA

LOCATION	DATE	DEPTH TO WATER	MEASURING POINT (MP)	App		
		(ft bMP)		MP ELEV. (ft)	. WATER ELEV (ft)	· COMMENTS
	•••••		********	•		•••••
BIG SPRING		0.00	Water surface			Spring - elev. not surveyed
BOYSCOUT SPRING		0.00	Water surface	5907.78	5907.78	Spring Spring
CALF SPRING		0.00	Water surface	5858.47	5858.47	Spring
CITY PARK SPRING		0.00	Water surface		3255111	Spring - elev. not surveyed
DOC KACKLEY SPRING		0.00	Water surface	5847.58	5847.58	Spring Stev. Not surveyed
FINCH SPRING		0.00	Water surface	5913.49	5913.49	Spring
FORMATION A SPRING		0.00	Water surface			Spring related pand
FORMATION B SPRING		0.00	Water surface			Spring related pond
FORMATION C SPRING		0.00	Water surface			
FORMATION SPRING		0.00	Water surface	6149.26	6149.26	Spring related pond
HARRIS WELL	12/02/92	17.72	Top of steel 1" pipe .	5877.56	5859.84	Spring
HARRIS WELL	12/03/92	17.84	Top of steel 1" pipe	5877.56	5859.72	MP = 4.05' above well-house floo
HARRIS WELL	12/07/92	17.72	Top of steel 1" pipe	5877.56	5859.84	MP = 4.05' above well-house floo
HARRIS WELL	5/28/93	14.02	Top of steel 1" pipe	5877.56	5863.54	MP = 4.05' above well-house floo
HARRIS WELL	10/19/93	17.10	Top of steel 1" pipe	5877.56		MP = 4.05' above well-house floo
HOMESTEAD SPRING		0.00	Water surface	5815.86	5860.46 5815.86	MP = 4.05' above well-house floor
HOOPER SPRING		0.00	Water surface	5853.78		Spring
KELLY PARK SPRING		0.00	Water surface		5853.78	Spring
KM-01	5/17/93	42.50		5897.72	5897.72	Spring
KM-02	5/18/93	34.59		6029.72	5987.22	
	5/18/93	25.55		6025.11	5990.52	
	5/18/93	35.89		6014.28	5988.73	
KM-05	5/18/93	31.88		6023.44	5987.55	
KM-06	5/18/93	24.55		6002.72	5970.84	
KM-07	5/17/93	35.07	•	5988.13	5963.58	
KM-08	5/19/93	30.49		6001.63	5966.56	
KM-09	5/18/93	29.77		5976.75	5946.26	
KM-10	5/17/93	42.10		5973.56	5943.79	
KM-11	5/18/93	25.49		6029.43	5987.33	
KM-12	5/19/93	27.33		6013.63	5988.14	
KM-13	5/19/93	27.98		5976.07	5948.74	
KM-15	5/19/93	37.53		5977.65	5949.67	
KM-16	5/19/93			5958.10	5920.57	
KH-17	5/19/93	54.97		5998.97	5944.00	·
KM-18		24.47		6001.11	5976.64	
KM-19	5/19/93	59.58		5958.25	5895.67	
LEDGER A SPRING	5/20/93	26.74		5975.17	5948.43	
LEDGER B SPRING		0.00	Water surface	5917.38	5917.38 s	pring
LEDGER C SPRING		0.00	Water surface	5911.08	5911.08 s	pring
EWIS WELL	E /47 /00	0.00	Water surface	5905.28	5905.28 s	pring
EWIS WELL	5/13/92	31.88	Top of steel well-cap	5864.35		P = ~1' ags
#113 A 1474 A	5/26/93	26.58	Top of steel well-cap	5864.35		P = ~1' ags
	10/29/93		Top of steel well-cap	5864.35		P = -1' ags
MORMON A SPRING			Water surface	5850.60		pring
IORMON B SPRING IORMON C SPRING		0.00	Water surface	5843.55		pring
		0.00	Water surface			

LOCATION	DATE	DEPTH TO WATER (ft bMP)	MEASURING POINT (MP)	MP ELEV. (ft)	WATER ELEV	. COMMENTS
PW-01	10/29/91	110.24	Small hole in well base	5987.37	E077 47	No.4 Of above 44
PW-01	2/04/92	109.59	Small hole in well base	5987.37 5987.37	5877.13	MP=1.8' above floor, pump on
PW-01	6/01/92	111.07	Small hole in well base	5987.37	5877.78 5876.30	MP=1.8' above floor, pump off
PW-01	6/01/92	116.40	Small hole in well base	5987.37		MP=1.8' above floor, pump off
PW-01	5/23/93	101.65	Small hole in well base	5987.37	5870.97 5885.72	MP=1.8' above floor, pump on
PW-01	10/29/93	107.84	Small hole in well base	5987.37	5879.53	MP=1.8/ above floor
PW-02	.0,2,,,,	107.104	Simil fore III well base	3701 .31	30/7.33	MP=1.8' above floor
PW-03	10/29/91	126.45	Small hole in well base	5988.58	5862.13	No water-level access
PW-03	2/04/92	124.64	Small hole in well base	5988.58	5863.94	MP=1.1' above floor, pump on
PW-03	6/01/92	127.85	Small hole in well base	5988.58	5860.73	MP=1.1' above floor, pump on MP=1.1' above floor, pump on
PH-03	5/23/93	117.22	Small hole in well base	5988.58	5871.36	MP=1.1' above floor
PW-03	10/29/93	122.23	Small hole in well base	5988.58	5866.35	MP=1.1' above floor
PW-04				2700.20	3000.37	No water-level access
SOUTHWEST SPRING		0.00	Water surface	5859.25	5859.25	Spring
SPRINGBOX SPRING		0.00	Water surface	5898.00	5898.00	Spring
TW-01						Well abandoned
TW-02	11/04/91	56.52	Small hole in well base	5989.06	5932.54	MP = 0.96' above well-house floor
TW-02	5/23/93	53.53	Small hole in well base	5989.06	5935.53	MP = 0.96' above well-house floor
TW-02	10/29/93	56.24	Top of steel casing	5989.06	5932.82	MP = 0.96' aw-hf, pump out
TW-03						Well abandoned
TW-04						Well abandoned
TW-05						Well abandoned
TW-06						Well abandoned
TW-07	10/17/91	14.84	Top of PVC well cap	5885.11	5870.27	
TW-07	5/12/92	15.21	Top of PVC well cap	5885.11	5869.90	
TW-07	5/30/92	15.16	Top of PVC well cap	5885.11	5869.95	
TW-07	11/04/92	15.52	Top of PVC well cap	5885.11	5869.59	
TW-07	11/05/92	15.55	Top of PVC well cap	5885.11	5869.56	
TW-07	12/02/92	15.58	Top of PVC well cap	5885.11	5869.53	
TW-07	5/27/93	14.30	Top of PVC well cap	5885.11	5870.81	
TW-07	10/22/93	15.22	Top of PVC well cap	5885.11	5869.89	
TH-08	10/17/91	14.34	Top of PVC well cap	5884.88	5870.54	
TW-08	5/12/92	14.62	Top of PVC well cap	5884.88	5870.26	
TW-08	5/30/92	14.60	Top of PVC well cap	5884.88	5870.28	
TW-08	10/14/92	14.95	Top of PVC well cap	5884.88	5869.93	
TW-08	11/04/92	14.95	Top of PVC well cap	5884.88	5869.93	
TW-08	12/02/92	15.00	Top of PVC well cap	5884.88	5869.88	
TW-08	5/27/93	13.72	Top of PVC well cap	5884.88	5871.16	
TW-08	10/22/93	14.64	Top of PVC well cap	5884.88	5870.24	
TW-09	10/15/91	9.49	Top of coupling	5884.91		Top of coupling = 0.28' above TOC
TW-09	10/17/91	9.46	Top of coupling	5884.91		Top of coupling = 0.28' above TOC
TW-09	5/12/92	8.30	Top of coupling	5884.91		Top of coupling = 0.28' above TOC
TW-09	5/30/92	8.34	Top of coupling	5884.91		Top of coupling = 0.28' above TOC
TW-09	10/14/92	9.43	Top of coupling	5884.91		Top of coupling = 0.28' above TOC
TW-09	11/04/92	9.57	Top of coupling	5884.91		Top of coupling = 0.28' above TOC
TW-09	12/02/92	9.59	Top of coupling	5884.91	5875.32	Top of coupling = 0.28' above TOC

		DEPTH				
LOCATION	DATE	TO WATER	MEASURING POINT (MP)	MP ELEV.	WATER ELE	V. COMMENTS
		(ft bMP)		(ft)	(ft)	CONTENT 3
TW-09	F /97 /97					
TW-09	5/27/93	6.67	Top of coupling	5884.91	5878.24	Top of coupling = 0.28' above TOC
TW-10	10/22/93	8.86	Top of coupling	5884.91	5876.05	Top of coupling = 0.28' above TOC
TW-10	10/15/91	15.76	Top of seal	5885.53	5869.77	Top of seal = 0.05' above TOC
TW-10	10/17/91	15.66	Top of seal	5885.53	5869 <b>.8</b> 7	Top of seal = 0.05' above TOC
TW-10	10/21/91	15.51	Top of seal	5885.53	5870.02	Top of seal = 0.05' above TOC
TW-10	5/12/92 5/30/02	15.95	Top of seal	5885.53	5869.58	Top of seal = 0.05' above TOC
TW-10	5/30/92 10/14/92	15.88	Top of seal	5885.53	5869.65	Top of seal = 0.05' above TOC
TW-10		16.21	Top of seal	5885.53	5869.32	Top of seal = 0.05' above TOC
TW-10	11/04/92	16.19	Top of seal	5885.53	5869.34	Top of seat = 0.05' above TOC
TW-10	12/02/92 5/27/93	16.29	Top of seal	5885.53	5869.24	Top of seal = 0.05' above TOC
TW-10	10/22/93	15.29	Top of seal	5885.53	5870.24	Top of seal = 0.05' above TOC
TW-11	10/15/91	15.88 74.63	Top of seal	5885.53	5869.65	Top of seal = 0.05' above TOC
TW-11	10/27/91		Top of coupling	5938.03	5863.40	Top of coupling = 0.25' above TOC
TW-11	5/12/92	74.29 73.93	Top of coupling	5938.03	5863.74	Top of coupling = 0.25' above TOC
TW-11	5/20/92	74.04	Top of coupling	5938.03	5864.10	Top of coupling = 0.25' above TOC
TW-11	10/13/92	73.90	Top of coupling	5938.03	5863.99	Top of coupling = 0.25' above TOC
TW-11	11/10/92	74.76	Top of coupling Top of coupling	5938.03	5864.13	Top of coupling = 0.25' above TOC
TW-11	12/02/92	73.28	Top of coupling	5938.03	5863.27	Top of coupling = 0.25' above TOC
TW-11	12/03/92	74.30	Top of coupling	5938.03	5864.75	Top of coupling = 0.25' above TOC
TW-11	12/05/92	74.42	Top of coupling	5938.03	5863.73	Top of coupling = 0.25' above TOC
<b>-</b>	5/26/93	68.85	Top of coupling	5938.03	5863.61	Top of coupling = 0.25' above TOC
<b>6</b>	10/20/93	72.98	Top of coupling	5938.03	5869.18	Top of coupling = 0.25' above TOC
TW-12	10/15/91	76.20	Top of seal	5938.03	5865.05	Top of coupling = 0.25' above TOC
TW-12	10/21/91		Top of seal	5939.23	5863.03	Top of seal = 0.07' above TOC
TW-12	5/12/92		Top of seal	5939.23	5863.15	Top of seal = 0.07' above TOC
TW-12	5/20/92		Top of seal	5939.23	5863.76	Top of seal = 0.07' above TOC
TW-12	10/12/92		Top of seal	5939.23	5863.69	Top of seal = 0.07' above TOC
TW-12	11/10/92		Top of seal	5939.23	5863.83	Top of seal = 0.07' above TOC
TW-12	12/02/92		Top of seal	5939.23	5862.93	Top of seal = 0.07' above TOC
TW-12	12/03/92		Top of seal	5939.23	5863.37	Top of seal = 0.07' above TOC
TW-12	12/07/92		Top of seal	5939.23 5939.23	5863.36	Top of seal = 0.07' above TOC
TW-12	5/26/93	_	Top of seal		5863.21	Top of seal = 0.07' above TOC
TW-12	10/20/93		Top of seal	5939.23 5939.23	5868.87	Top of seal = 0.07' above TOC
TW-13	10/15/91		Top of seal		5864.72	Top of seal = 0.07' above TOC
TW-13	10/20/91		Top of seal	5988.15	5966.55	Top of seal = 0.04' above TOC
TW-13	5/19/92		Top of seal	5988.15 5988.15	5966.75	Top of seal = 0.04' above TOC
TW-13	5/30/92		Top of seal		5970.05 5960.65	Top of seal = 0.04' above TOC
TW-13	10/12/92		Top of coupling	5988.15 5988.35	5969.65	Top of seal = 0.04' above TOC
TW-13	11/18/92		Top of coupling	5988.35	5965.40 5964.05	MP-should have been top of seal
TW-13	5/29/93		Top of coupling	5988.35		MP-should have been top of seal
TW-13	10/26/93			5988.15		MP-should have been top of seal
TW-14	10/15/91			5988.59		Top of seal = 0.04' above TOC
TW-14	5/19/92		to the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the	5988.59		BOC = -23' bMP
TW- 14	5/30/92					BOC = ~23' bMP
TW- 14	10/13/92			5988.59		BOC = ~23' bMP
						well may be dry, BOC = -23' bMP

		DEPTH				
LOCATION	DATE	TO WATER	MEASURING POINT (MP)	MP ELEV.	WATER ELEV.	COMMENTS
		(ft bMP)		(ft)	(ft)	COMMENTS
		•••••				*************************
TW-14	11/17/92	0.00	Top of PVC casing	5988.59		well may be dry, BOC = -23' bMP
TW-14	5/29/93	12.74	Top of PVC casing	5988.59	5975.85	BOC = -23' bMP
TW-14	10/26/93	16.47	Top of PVC casing	5988.59	5972.12	BOC = -23' bMP
TW-15	10/15/91	22.67	Top of seal	5988.27	5965.60	Top of seal = 0.04' above TOC
TW-15	10/20/91	21.40	Top of seal .	5988.27	5966.87	Top of seal = 0.04' above TOC
TW-15	5/19/92	19.00	Top of seal	5988.27	5969.27	Top of seal = 0.04' above TOC
TW-15	5/30/92	19.46	Top of seal	5988.27	5968.81	Top of seal = 0.04' above TOC
TW- 15	10/13/92	23.60	Top of seal	5988.27	5964.67	Top of seal = 0.04' above TOC
TW-15	11/09/92	22.57	Top of seal	5988.27	5965.70	Top of seal = 0.04' above TOC
TW-15	11/11/92	22.52	Top of seal	5988.27	5965.75	Top of seal = 0.04' above TOC
TW-15	5/29/93	14.93	Top of seal	5988.27	5973.34	Top of seal = 0.04' above TOC
TW-15	10/26/93	18.91	Top of seal .	5988.27	5969.36	Top of seal = 0.04' above TOC
TW-16	10/16/91	65.74	Top of seal	5998.39	5932.65	Top of seal = 0.04' above TOC
TW-16	10/17/91	65.76	Top of seal	5998.39	5932.63	Top of seal = 0.04' above TOC
TW-16	10/23/91	65.84	Top of seal	5998.39	5932.55	Top of seal = 0.04' above TOC
TW-16	5/19/92	65.31	Top of seal	5998.39	5933.08	Top of seal = 0.04' above TOC
TW-16	5/30/92	65.25	Top of seal	5998.39	5933.14	Top of seal = 0.04' above TOC
TW-16	10/13/92	65.83	Top of seal	5998.39	5932.56	Top of seal = 0.04' above TOC
TW-16	11/09/92	66.00	Top of seal	5998.39	5932.39	Top of seal = 0.04' above TOC
TW-16	5/27/93	63.07	Top of seal	5998.39	5935.32	Top of seal = 0.04' above TOC
TW-16	10/27/93	64.76	Top of seal	5998.39	5933.63	Top of seal = 0.04' above TOC
TW-17	10/16/91	65.69	Top of seal	5998.33	5932.64	Top of seal = 0.04' above TOC
TŅ-17	10/17/91	65.70	Top of seal	5998.33	5932.63	Top of seal = 0.04' above TOC
TW-17	5/19/92	65.25	Top of seal	5998.33	5933.08	Top of seal = 0.04' above TOC
TW-17	5/30/92	65.19	Top of seal	5998.33	5933.14	Top of seal = 0.04' above TOC
TW-17	10/13/92	65 <b>.78</b>	Top of seal	5998.33	5932.55	Top of seal = 0.04' above TOC
TW-17	11/05/92	65 <b>.7</b> 5	Top of seal	5998.33	5932.58	Top of seal = 0.04' above TOC
TW-17	5/27/93	63.00	Top of seal	5998.33	5935.33	Top of seal = 0.04' above TOC
TW-17	10/27/93	64.70	Top of seal	5998.33		Top of seal = 0.04' above TOC
TW-18	10/16/91	63.40	Top of seal	5996.89		Top of seal = 0.04' above TOC
TW-18	10/17/91	63.29	Top of seal	5996.89		Top of seal = 0.04' above TOC
TW-18	10/23/91	63.52	Top of seal	5996.89		Top of seal = 0.04' above TOC
TW-18	5/19/92	62.99	Top of seal	5996.89		Top of seal = 0.04' above TOC
TW- 18	5/30/92	62.84	Top of seal	5996.89		Top of seal = 0.04' above TOC
TW-18	10/13/92	63.69	Top of seal	5996.89		Top of seal = 0.04' above TOC
TW-18	11/05/92	63.85	Top of seal	5996.89	5933.04	Top of seal = 0.04' above TOC
TW-18	5/27/93	60.66	Top of seal	5996.89		Top of seal = 0.04' above TOC
TW-18	10/27/93	62.34	Top of seal	5996.89		Top of seal = 0.04' above TOC
TW-19	10/14/91		Top of PVC casing	5893.07		well dry, BOC = 30.87' bMP
TW-19	10/18/91		Top of PVC casing	5893.07		well dry, BOC = 30.87' bMP
TW-19	5/15/92		Top of PVC casing	5893.07		well dry, BOC = 30.87' bMP
TW-19	5/18/92		Top of PVC casing	5893.07		well dry, BOC = 30.87' bMP
TW-19	10/13/92		Top of PVC casing	5893.07		well dry, BOC = 30.87' bMP
TW-19	11/04/92		Top of PVC casing	5893.07		well dry, BOC = 30.87' bMP
TW-19	12/02/92		Top of PVC casing	5893.07		well dry, BOC = 30.87' bMP
TW-19	5/26/93	26.32	Top of PVC casing	5893.07	5866.75	

LOCATION		DEPTH	110 4 41 40 414 414			
LUCATION	DATE	TO WATER	MEASURING POINT (MP)	MP ELEV.		COMMENTS
	• • • • • • • • • • • • • • • • • • • •	(ft bMP)		(ft)	(ft)	
TW-19	10/28/93		Top of PVC casing	5893.07	• • • • • • • • • • • • • • • • • • • •	
TW-20	10/14/91	31.57	Top of seal	5893.37	ED/4 00	well dry, BOC = 30.87' bMP
TW-20	10/16/91	31.57	Top of seal	5893.37	5861.80	Top of seal = 0.05' above TOC
TW-20	10/18/91	31.54	Top of seal	5893.37	5861.80 5861.83	Top of seal = 0.05' above TOC
TW-20	10/27/91	31.45	Top of seal	5893.37	5861.92	Top of seal = 0.05' above TOC
TW-20	5/14/92	31.32	Top of seal	5893.37	5862.05	Top of seal = 0.05' above TOC
TW-20	5/18/92	31.31	Top of seal	5893.37	5862.06	Top of seal = 0.05' above TOC
TW-20	10/13/92	31.70	Top of seal	5893.37	5861.67	Top of seal = 0.05' above TOC
TW-20	11/04/92	32.30	Top of seal	5893.37	5861.07	Top of seal = 0.05' above TOC
TW-20	11/09/92	32.25	Top of seal	5893.37	5861.12	Top of seal = 0.05' above TOC
TW-20	12/02/92	32.35	Top of seal	5893.37	5861.02	Top of seal = 0.05' above TOC
TW-20	5/25/93	26.62	Top of seal .	5893.37	5866. <i>7</i> 5	Top of seal = 0.05' above TOC
TW-20	5/26/93	26.63	Top of seal	5893.37	5866.74	Top of seal = 0.05' above TOC
TW-20	10/28/93	31.29	Top of seal	5893.37	5862.08	Top of seal = 0.05' above TOC
TW-21	10/14/91	26.77	Top of coupling	5893.68	5866.91	Top of seal = 0.05' above TOC
TW-21	10/18/91	26.72	Top of coupling	5893.68	5866.96	Top of coupling = 0.26' above TOC
TW-21	5/15/92	26.00	Top of coupling	5893.68	5867.68	Top of coupling = 0.26' above TOC
TW-21	5/18/92	26.08	Top of coupling	5893.68	5867.60	Top of coupling = 0.26' above TOC
TW-21	5/20/92	26.05	Top of coupling	5893.68	5867.63	Top of coupling = 0.26' above TOC
TW-21	10/13/92	26.36	Top of coupling	5893.68	5867.32	Top of coupling = 0.26' above TOC
TV-21	11/05/92	27.17	Top of coupling	5893.68	5866.51	Top of coupling = 0.26' above TOC
	12/02/92	26.60	Top of coupling	5893.68	5867.08	Top of coupling = 0.26' above TOC
	5/26/93	22.22	Top of coupling	5893.68	5871.46	Top of coupling = 0.26' above TOC
TW-21	10/28/93	25.88	Top of coupling	5893.68	5867.80	Top of coupling = 0.26' above TOC
TW-22	10/16/91	73.38	Top of seal	5954.70	5881.32	Top of coupling = 0.26' above TOC Top of seal = 0.05' above TOC
TW-22	10/22/91	73.36	Top of seal	5954.70	5881.34	Top of seal = 0.05' above TOC
TW-22	5/15/92	72.61	Top of seal	5954.70	5882.09	Top of seal = 0.05' above TOC
TW-22	5/20/92	72.57	Top of seal	5954.70	5882.13	Top of seal = 0.05' above TOC
TW-22	5/30/92	72.56	Top of seal	5954.70	5882.14	Top of seal = 0.05' above TOC
TW-22	10/13/92	73.56	Top of seal	5954.70		Top of seal = 0.05' above TOC
TW-22	11/11/92	73.55	Top of seal	5954.70	_	Top of seal = 0.05' above TOC
TW-22	12/02/92	73.60	Top of seal	5954.70		Top of seal = 0.05' above TOC
TW-22	5/25/93	71.38	Top of seal	5954.70		Top of seal = 0.05' above TOC
TW-22	10/21/93	72.86	Top of seal	5954.70		Top of seal = 0.05' above TOC
TW-23	10/16/91	73.99	Top of seal	5954.52		Top of seal = 0.07' above TOC
TV-23	10/23/91	<b>73.9</b> 5	Top of seal	5954.52		Top of seal = 0.07' above TOC
TW-23	5/20/92	72.40	Top of seal	5954.52		Top of seal = 0.07' above TOC
TW-23	5/30/92	72.36	Top of seal	5954.52		Top of seal = 0.07' above TOC
TW-23	10/13/92	73.90	Top of seal	5954.52		Top of seal = 0.07' above TOC
TW-23	11/06/92	74.00	Top of seal	5954.52		Top of seal = 0.07' above TOC
TW-23	12/02/92	74.06	Top of seal	5954.52		Top of seal = 0.07' above TOC
TW-23	5/28/93	71.17	Top of seal	5954.52		Top of seal = 0.07' above TOC
TW-23	10/21/93	73.24	Top of seal	5954.52		Top of seal = 0.07' above TOC
TW-24	10/22/91	73.06	Top of PVC casing	5954.43	5881.37	and - and - and Inc
TW-24	5/20/92	72.29	Top of PVC casing	5954.43	5882.14	•
TV-24	5/30/92	72.26	Top of PVC casing	5954.43	5882.17	

LOCATION	DATE	DEPTH TO WATER (ft bMP)	MEASURING POINT (MP)	MP ELEV. (ft)	WATER ELEV	. COMMENTS
		(11 017 )	***************************************	(11)	(ft)	
TW-24	10/13/92	73.20	Top of PVC casing	5954.43	5881.23	
TW-24	11/06/92	73.25	Top of PVC casing	5954.43	5881.18	
TW-24	12/02/92	73.26	Top of PVC casing	5954.43	5881.17	
TW-24	5/28/93	71.03	Top of PVC casing	5954.43	5883.40	
TW-24	10/21/93	72.55	Top of PVC casing	5954.43	5881.88	
TW-25				3734.43	3001.00	Well abandoned
TW-26	10/16/91	89.10	Top of seal	5991.42	5902.32	Top of seal = 0.04' above TOC
TW-26	10/18/91	89.24	Top of seal	5991.42	5902.18	Top of seal = 0.04' above TOC
TW-26	5/20/92	88.99	Top of seal	5991.42	5902.43	Top of seal = 0.04' above TOC
TW-26	5/30/92	89.00	Top of seal	5991.42	5902.42	Top of seal = 0.04' above TOC
TW-26	10/13/92	88.42	Top of seal	5991.42	5903.00	Top of seal = 0.04' above TOC
TW-26	11/06/92	89.10	Top of seal .	5991.42	5902.32	Top of seal = 0.04' above TOC
TW-26	11/10/92	89.11	Top of seal	5991.42	5902.31	Top of seal = 0.04' above TOC
TW-26	5/28/93	85.16	Top of seal	5991.42	5906.26	Top of seal = 0.04' above TOC
TW-26	10/28/93	86.59	Top of seal	5991.42	5904.83	Top of seal = 0.04' above TOC
TW-27						Well abandoned
TW-28	10/14/91	44.46	Top of seal	5989.40	5944.94	Top of seal = 0.05' above TOC
TW-28	10/17/91	44.51	Top of seal	5989.40	5944.89	Top of seal = 0.05' above TOC
TW-28	5/18/92	43.28	Top of seal	5989.40	5946.12	Top of seal = 0.05' above TOC
TW-28	5/30/92	43.23	Top of seal	5989.40	5946.17	Top of seal = 0.05' above TOC
TW-28	10/13/92	44.81	Top of seal	5989.40	5944.59	Top of seal = 0.05' above TOC
TW-28	11/06/92	45.05	Top of seal	5989.40	5944.35	Top of seal = 0.05' above TOC
TW-28	5/27/93	40.35	Top of seal	5989.40	5949.05	Top of seal = 0.05' above TOC
TW-28	10/20/93	42.95	Top of seal	5989.40	5946.45	Top of seal = 0.05' above TOC
TW-29	10/14/91	44.65	Top of coupling	5989.59	5944.94	Top of coupling = 0.27' above TOC
TW-29	10/17/91	44.65	Top of coupling	5989.59	5944.94	Top of coupling = 0.27' above TOC
TW-29	5/18/92	43.47	Top of coupling	5989.59	5946.12	Top of coupling = 0.27' above TOC
TW-29	5/30/92	43.36	Top of coupling	5989.59	5946.23	Top of coupling = 0.27' above TOC
TW-29	10/13/92	45.00	Top of coupling	5989.59	5944.59	Top of coupling = 0.27' above TOC
TW-29	11/12/92	45.25	Top of coupling	5989.59		Top of coupling = 0.27' above TOC
TW-29	5/27/93	40.50	Top of coupling	5989.59	5949.09	Top of coupling = 0.27' above TOC
TW-29	10/20/93	43.14	Top of coupling	5989.59	5946.45	Top of coupling = 0.27' above TOC
TW-30	10/18/91	63.07	Top of PVC casing	5992.48	5929.41	
TW-30	5/22/92	63.16	Top of coupling	5992.73		Top of coupling = 0.25' above TOC
TW-30	5/30/92	63.20	Top of coupling	5992.73		Top of coupling = 0.25' above TOC
TW-30	10/13/92	63.25	Top of coupling	5992.73		Top of coupling = 0.25' above TOC
TW-30	11/06/92	63.40	Top of coupling	5992.73		Top of coupling = 0.25' above TOC
TW-30	5/31/93	62.29	Top of coupling	5992.73		Top of coupling = 0.25' above TOC
TW-30 TW-31	10/27/93	62.96	Top of coupling	5992.73		Top of coupling = 0.25' above TOC
TW-31	10/15/91	30.42	Top of PVC casing	5975.29	5944.87	
TW-31	10/22/91 5/27/02	30.08	Top of PVC casing	5975.29	5945.21	
TW-31	5/27/92 5/30/02	26.90	Top of PVC casing	5975.29	5948.39	÷ .
TW-31	5/30/92 10/1//92	27.00	Top of PVC casing	5975.29	5948.29	
TW-31	10/14/92	31.15	Top of PVC casing	5975.29	5944.14	
	11/06/92	30.46	Top of PVC casing	5975.29	5944.83	
TW-31	6/01/93	22.62	Top of PVC casing	5975.29	5952.67	

LOCATION	DATE	DEPTH TO WATER (ft bMP)	MEASURING POINT (MP)	MP ELEV. (ft)	. WATER ELEY	V. COMMENTS
TW-31	10/22/93	26.73	Top of PVC casing	5975.29	FO/0 F/	
TW-32	10/15/91	32.49	Top of PVC casing	5975.67	5948.56 5943.18	
TW-32	10/22/91	32.46	Top of coupling	5975.87 5975.91	5943.18 5943.45	•
TW-32	10/26/91	32.22	Top of coupling	5975.91	5943.69	Top of coupling = 0.24' above TOC
TW-32	5/27/92	29.22	Top of coupling.	5975.91	5946.69	Top of coupling = 0.24' above TOC
TW-32	5/30/92	29.30	Top of coupling	5975.91	5946.61	Top of coupling = 0.24' above TOC
TW-32	10/14/92	33.16	Top of coupling	5975.91	5942.75	Top of coupling = 0.24' above TOC
TW-32	11/12/92	32.62	Top of coupling	5975.91	5943.29	Top of coupling = 0.24' above TOC
TW-32	11/13/92	32.74	Top of coupling	5975.91	5943.17	Top of coupling = 0.24' above TOC
TW-32	11/16/92	32.47	Top of coupling	5975.91	5943.44	Top of coupling = 0.24' above TOC
TW-32	6/01/93	25.02	Top of coupling	5975.91	5950.89	Top of coupling = 0.24' above TOC Top of coupling = 0.24' above TOC
TW-32	6/02/93	25.00	Top of coupling .	5975.91	5950.91	Top of coupling = 0.24' above TOC
TW-32	10/22/93	28.84	Top of coupling	5975.91	5947.07	Top of coupling = 0.24' above TOC
TW-33	10/15/91	31.80	Top of seal	5975.68	5943.88	Top of seal = 0.07' above TOC
TW-33	10/22/91	31.51	Top of seal	5975.68	5944.17	Top of seal = 0.07' above TOC
TW-33	5/27/92	28.15	Top of seal	5975.68	5947.53	Top of seal = 0.07' above TOC
TW-33	5/30/92	28.28	Top of seal	5975.68	5947.40	Top of seal = 0.07' above TOC
TW-33	11/12/92	31.68	Top of coupling	5975.86	5944.18	MP=should have been top of seal
TW-33	11/13/92	31.67	Top of coupling	5975.86	5944.19	MP=should have been top of seal
TW-33	6/01/93	23.98	Top of coupling	5975.86	5951.88	MP=should have been top of seal
TV-23	10/22/93	27. <del>96</del>	Top of seal	5975.68	5947.72	Top of seal = 0.07' above TOC
	10/14/91	31.37	Top of PVC casing	5893.16	5861.79	, and all about 100
Page 17.	10/18/91	31.62	Top of coupling	5893.43	5861.81	Top of coupling = 0.27' above TOC
TW-34	5/15/92	31.37	Top of coupling	5893.43	5862.06	Top of coupling = 0.27' above TOC
TW-34 TW-34	5/18/92	31.45	Top of coupling	5893.43	5861.98	Top of coupling = 0.27' above TOC
TW-34	10/13/92	31.72	Top of coupling	5893.43	5861.71	Top of coupling = 0.27' above TOC
TW-34	11/04/92	32.37	Top of coupling	5893.43	5861.06	Top of coupling = 0.27' above TOC
	12/02/92	32.37	Top of coupling	5893.43	5861.06	Top of coupling = 0.27' above TOC
TW-34 TW-34	5/26/93	26.67	Top of coupling	5893.43	5866.76	Top of coupling = 0.27' above TOC
TW-35	10/28/93	31.29	Top of coupling	5893.43	5862.14	Top of coupling = 0.27' above TOC
TW-35	10/16/91	34.61	Top of seal	5897.16	5862.55	Top of seal = 0.04' above TOC
TW-35	10/21/91		Top of seal	5897.16	5862.66	Top of seal = 0.04' above TOC
TW-35	5/21/92		Top of seal	5897.16	5862.84	Top of seal = 0.04' above TOC
TW-35	5/30/92		Top of seal	5897.16	5862.82	Top of seal = 0.04' above TOC
TW-35	10/13/92		Top of seal	5897.16	5862.42	Top of seal = 0.04' above TOC
TW-35	11/11/92		Top of seal	5897.16	5861.79	Top of seal = 0.04' above TOC
TW-35	12/02/92		Top of seal	5897.16	5861.79	Top of seal = 0.04' above TOC
TW-35	5/26/93		Top of seal	5897.16	5867.50	Top of seal = 0.04' above TOC
TW-36	10/28/93		Top of seal	5897.16	5862.84	Top of seal = 0.04' above TOC
TW-36	10/17/91		Ground surface	5903.77		Well melted. New TOC = 3' ags
TW-36	10/26/91 5/14/92		Top of seal	5906.81		Top of seal = 0.04' above TOC
TW-36	5/30/92		Top of seal	5906.81		Top of seal = 0.04' above TOC
TW-36	10/13/92		Top of seal	5906.81		Top of seal = 0.04' above TOC
TW-36	11/09/92		Top of seal	5906.81		Top of seal = 0.04' above TOC
TW-36	11/10/92		Top of seal	5906.81		Top of seal = 0.04' above TOC
	, , , , ,	52.05	Top of seal	5906.81	5874.76	Top of seal = 0.04' above TOC

LOCATION	DATE	DEPTH TO WATER (ft bMP)	MEASURING POINT (MP)	MP ELEV.	WATER ELEV.	COMMENTS
TW-36	12/02/92	32.26	Top of seal	5906.81	5874.55	Top of seal = 0.04' above TOC
TW-36	5/27/93	28.91	Top of seal	5906.81	5877.90	Top of seal = 0.04' above TOC
TW-36	10/28/93	31.45	Top of seal	5906.81	5875.36	Top of seal = 0.04' above TOC
TW-37	10/15/91	71.77	Top of seal	5959.17	5887.40	Top of seal = 0.03' above TOC
TW-37	10/21/91	71.79	Top of seal	5959.17	5887.38	Top of seal = 0.03' above TOC
TW-37	5/13/92	68.59	Top of seal	5959.17	5890.58	Top of seal = 0.03' above TOC
TW-37	5/18/92	68.57	Top of seal	5959.17	5890.60	Top of seal = 0.03' above TOC
TW-37	10/13/92	71.84	Top of seal	5959.17	5887.33	Top of seal = 0.03' above TOC
TW-37	11/17/92	71.91	Top of seal	5959.17	5887.26	Top of seal = 0.03' above TOC
TW-37	12/02/92	71.91	Top of seal	5959.17	5887.26	Top of seal = 0.03' above TOC
TW-37	6/01/93	66.75	Top of seal	5959.17	5892.42	Top of seal = 0.03' above TOC
TW-37	10/27/93	70.85	Top of seal ·	5959.17	5888.32	Top of seal = 0.03' above TOC
TW-38	10/17/91	97.92	Top of PVC casing	5972.91	5874.99	
TW-38	10/24/91	97.50	Top of PVC casing	5972.91	5875.41	
TW-38	5/21/92	98.45	Top of PVC casing	5972.91	5874.46	
TW-38	5/30/92	98.69	Top of PVC casing	5972.91	5874.22	
TW-38	10/12/92	94.75	Top of PVC casing	5972.91	5878.16	
TW-38	11/17/92	86.52	Top of PVC casing	5972.91	5886.39	
TW-38	12/02/92	97.60	Top of PVC casing	5972.91	5875.31	
TW-38	5/31/93	89.44	Top of PVC casing	5972.91	5883.47	
TW-38	10/22/93	94.40	Top of PVC casing	5972.91	5878.51	
TW-39	10/16/91	35.28	Top of seal	5897.07	5861.79	Top of seal = 0.04' above TOC
TW-39	10/21/91	35.22	Top of seal	5897.07	5861.85	Top of seal = 0.04' above TOC
TW-39	5/21/92	35.13	Top of seal	5897.07	5861.94	Top of seal = 0.04' above TOC
TW-39	5/30/92	35.16	Top of seal	5897.07	5861.91	Top of seal = 0.04' above TOC
TW-39	10/13/92	35.40	Top of seal	5897.07	5861.67	Top of seal = 0.04' above TOC
TW-39	11/05/92	36.00	Top of seal	5897.07	5861.07	Top of seal = 0.04' above TOC
TW-39	12/02/92	36.06	Top of seal	5897.07	5861.01	Top of seal = 0.04' above TOC
TW-39	5/26/93	30.33	Top of seal	5897.07	5866.74	Top of seal = 0.04' above TOC
TW-39	10/28/93	34.99	Top of seal	5897.07	5862.08	Top of seal = 0.04' above TOC
TW-40	10/16/91	88.43	Top of PVC casing	5989.90	5901.47	
TW-40	10/27/91	88.45	Top of seal	5 <b>98</b> 9.94	5901.49	Top of seal = 0.04' above TOC
TW-40	2/04/92	88.72	Top of seal	5989.94	5901.22	Top of seal = 0.04' above TOC
TW-40	5/26/92	88.70	Top of seal	5989.94	5901.24	Top of seal = 0.04' above TOC
TW-40	5/30/92	88.69	Top of seal	5989.94	5901.25	Top of seal = 0.04' above TOC
TW-40	11/14/92	80.35	Top of seal	5989.94	5909.59	Top of seal = 0.04' above TOC
TW-40	11/16/92	79.95	Top of seal	5989.94		Top of seal = 0.04' above TOC
TW-40	5/31/93	73.21	Top of seal	5989.94	5916.73	Top of seal = 0.04' above TOC
TU-40	10/21/93	72.96	Top of seal	5989.94		Top of seal = 0.04' above TOC
TW-41	10/18/91	62.71	Top of PVC casing	5994.01	5931.30	
TW-41	5/22/92	62.36	Top of coupling	5994.31		Top of coupling = 0.3' above TOC
TW-41	5/30/92	62.30	Top of coupling	5994.31		Top of coupling = 0.3′ above TOC
TW-41	10/13/92	62.86	Top of coupling	5994.31		Fop of coupling = 0.3' above TOC
TW-41	11/14/92	63.10	Top of coupling	5994.31		Top of coupling = 0.3′ above TOC
TW-41	5/31/93	59.66	Top of coupling	5994.31		Top of coupling = 0.3′ above TOC
TW-41	10/26/93	61.26	Top of coupling	5994.31	5933.05 1	op of coupling = 0.3' above TOC

LOCATION	DATE	DEPTH TO WATER (ft bMP)	MEASURING POINT (MP)	MP ELEV. (ft)	WATER ELE	V. COMMENTS
TW-42	10/16/91	85.79	Top of PVC casing	5990.03	5904.24	• • • • • • • • • • • • • • • • • • • •
TW-42	10/17/91	85.75	Top of PVC casing	5990.03	5904.28	
TW-42	10/27/91	86.11	Top of seal	5990.07	5903.96	Top of seal = 0.04' above TOC
rw-42	5/29/92	84.99	Top of seal	5990.07	5905.08	Top of seal = 0.04' above TOC
rw-42	5/30/92	85.10	Top of seal	5990.07	5904.97	Top of seal = 0.04' above TOC
TW-42	11/13/92	83.00	Top of seal	5990.07	5907.07	Top of seal = 0.04' above TOC
rw-42	5/31/93	79.37	Top of seal	5990.07	5910.70	Top of seal = 0.04' above TOC
W-42	10/27/93	79.75	Top of seal	5990.07	5910.32	Top of seal = 0.04' above TOC
W-43	10/16/91	88.15	Top of seal	5989.12	5900.97	Top of seal = 0.04' above TOC
W-43	10/17/91	88.72	Top of PVC casing	5989.08	5900.36	Pump out of well
W-43	5/22/92	87.75	Top of PVC casing	5989.08	5901.33	Pump out of well
W-43	11/17/92	78.67	Top of PVC casing .	5989.08	5910.41	Pump out of well
W-43	5/31/93	71.40	Top of PVC casing	5989.08	5917.68	Pump out of well
W-43	5/31/93	71.41	Top of PVC casing	5989.08	5917.67	Pump out of well
W-43	10/22/93	71.40	Top of PVC casing	5989.08	5917.68	Pump out of well
W-44						Well abandoned
W-44A	10/16/91	99.78	Top of seal	5989.41	5889.63	Top of seal = 0.04' above TOC
W-44A	10/17/91	99.41	Top of seal	5989.41	5890.00	Top of seal = 0.04' above TOC
H-44A	10/20/91	99.33	Top of seal	5989.41	5890.08	Top of seal = 0.04' above TOC
H-44A	5/26/92	99.98	Top of seal	5989.41	5889.43	Top of seal = 0.04' above TOC
H-44A	5/27/92	100.08	Top of seal	5989.41	5889.33	Top of seal = 0.04' above TOC
	11/14/92	99.12	Top of seal	5989.41	5890.29	Top of seal = 0.04' above TOC
* 44A	11/16/92	98.60	Top of seal	5989.41	5890.81	Top of seal = 0.04' above TOC
1-44A	5/31/93	91.85	Top of seal	5989.41	5897.56	
1-44A	10/21/93	95.84	Top of seal	5989.41	5893.57	Top of seal = 0.04' above TOC Top of seal = 0.04' above TOC
<i>t</i> -45	10/15/91	74.35	Top of PVC casing	5958.91	5884.56	100 01 seat 2 0.04. above 100
<b>1-45</b>	10/21/91	74.60	Top of coupling	5959.17	5884.57	Top of comiting - 0 244 -1
1-45	5/18/92	72.70	Top of coupling	5959.17	5886.47	Top of coupling = 0.26' above TO
1-45	5/30/92	72.70	Top of coupling	5959.17	5886.47	Top of coupling = 0.26' above TO
1-45	10/13/92	74.55	Top of coupling	5959.17	5884.62	Top of coupling = 0.26' above TO
1-45	11/09/92	74.54	Top of coupling	5959.17	5884.63	Top of coupling = 0.26' above TO Top of coupling = 0.26' above TO
1-45	6/01/93	71.57	Top of coupling	5959.17	5887.60	Top of coupling = 0.26' above TO
	10/27/93	73.68	Top of coupling	5959.17	5885.49	Top of coupling = 0.26' above TO
	10/16/91	62.89	Top of seal	5989.19	5926.30	Top of seal = 0.04' above TOC
	10/23/91	62.63	Top of seal	5989.19		Top of seal = 0.04' above TOC
-48	1/31/92	63.64	Top of seal	<del>59</del> 89.19		Top of seal = 0.04' above TOC
-48	5/30/92	62.42	Top of coupling	5989.40		
	10/12/92	62.34	Top of coupling	5989.40		Top of coupling = 0.25' above TOO Top of coupling = 0.25' above TOO
	11/10/92	63.70	Top of coupling	5989.40		Top of coupling = 0.25' above TOO
-48	5/29/93	61.04	Top of coupling	5989.40		Top of coupling = 0.25' above TOC
-48	6/02/93		Top of coupling	5989.40		Top of coupling = 0.25' above TOC
	10/20/93		Top of coupling	5989.40	5927.81	Top of coupling = 0.25' above TOD
	10/16/91		Top of seal	5996.94		Top of coupling = 0.25' above TOC
	10/23/91		Top of seal	5996.94		Top of seal = 0.04' above TOC
49	1/31/92		Top of seal	5996.94		Top of seal = 0.04' above TOC
42	5/22/92		Top of seal			Top of seal = 0.04' above TOC Top of seal = 0.04' above TOC

LOCATION	DATE	DEPTH TO WATER	MEASURING POINT (MP)	Mb Fire		. •
		(ft bMP)		MP ELEV. (ft)	. WATER ELEV (ft)	COMMENTS
		********		•		***************************************
TW-49	5/30/92	73.71	Top of seal	5996.94	5923.23	Top of seal = 0.04' above TOC
TW-49	10/12/92	73.44	Top of seal	5996.94	5923.50	Top of seal = 0.04' above TOC
TW-49	11/06/92	74.26	Top of seal	5996.94	5922.68	Top of seal = 0.04' above TOC
TW-49	5/29/93	72.49	Top of seal	5996.94	5924.45	Top of seal = 0.04' above TOC
TW-49	10/20/93	72.96	Top of seal	5996.94	5923.98	Top of seal = 0.04' above TOC
TW-50	10/16/91	60.73	Top of seal	5992.94	5932.21	Top of seal = 0.04' above TOC
TW-50	10/23/91	60.77	Top of seal	5992.94	5932.17	Top of seal = 0.04' above TOC
TW-50	5/29/92	60.26	Top of seal	5992.94	5932.68	Top of seal = 0.04' above TOC
TW-50	5/30/92	60.25	Top of seal	5992.94	5932.69	Top of seal = 0.04' above TOC
TW-50	10/13/92	60.78	Top of seal	5992.94	5932.16	Top of seal = 0.04' above TOC
TW-50	11/17/92	61.00	Top of seal	5992.94	5931.94	Top of seal = 0.04' above TOC
TW-50	5/29/93	58.29	Top of seal .	5992.94	5934.65	Top of seal = 0.04' above TOC
TW-50	10/26/93	59.92	Top of seal	5992.94	5933.02	Top of seal = 0.04' above TOC
TW-51	10/29/91	47.28	Top of steel casing	5995.57	5948.29	
TW-51	5/30/92	44.08	Top of steel casing	5995.57	5951.49	
TW-51	10/12/92	48.67	Top of steel casing	5995.57	5946.90	
TW-51	11/17/92	47.83	Top of steel casing	5995.57	5947.74	
TW-51	6/02/93	50.32	Top of ext. steel casing	6001.57	5951.25	Extended by ~6'. TOC ~9' ags.
TW-51	10/26/93	54.79	Top of ext. steel casing	6001.57	5946.78	Extended by -6'. TOC -9' ags.
TW-53	11/02/92	22.15	Top of PVC casing	5880.39	5858.24	Top of PVC casing = 2.04' ags
TW-53	11/06/92	22.17	Top of PVC casing	5880.39		Top of PVC casing = 2.04' ags
TW-53	11/10/92	22.19	Top of PVC casing	5880.39	5858.20	Top of PVC casing = 2.04' ags
TW-53	12/02/92	22.41	Top of PVC casing	5880.39	5857.98	Top of PVC casing = 2.04' ags
TW-53	5/20/93	17.85	Top of PVC casing	5880.39	5862.54	Top of PVC casing = 2.04' ags
TW-53	5/28/93	18.31	Top of coupling	5880.65	5862.34	Top of coupling = 0.26' above TOC
TW-53	10/26/93	21.70	Top of coupling	5880.65		Top of coupling = 0.26' above TOC
TW-54	11/05/92	31.82	Top of PVC casing	5888.96		Top of PVC casing = 2.26' ags
TW-54	11/06/92	31.82	Top of PVC casing	5888.96		Top of PVC casing = 2.26' ags
TW-54	11/10/92	31.85	Top of PVC casing	5888.96		Top of PVC casing = 2.26' ags
TW-54	12/02/92	31.95	Top of PVC casing	5888.96		
TW-54	5/20/93	26.18	Top of PVC casing	5888.96		Top of PVC casing = 2.26' ags
TW-54	5/25/93	26.35	Top of coupling	5889.21		Top of PVC casing = 2.26' ags Top of coupling = 0.25' above TOC
TW-54	10/23/93	30.79	Top of coupling	5889.21		Top of coupling = 0.25' above TOC
TW-55	10/21/92	31.28	Top of PVC casing	5886.33		Top of PVC casing = 2.0' ags
TW-55	10/23/92	31.35	Top of PVC casing	5886.33		
TW-55	10/24/92	31.37	Top of PVC casing	5886.33		Top of PVC casing = 2.0' ags
TW-55	10/27/92	31.46	Top of PVC casing	5886.33		Top of PVC casing = 2.0' ags
TW-55	11/02/92	31.64	Top of PVC casing	5886.33		Top of PVC casing = 2.0' ags
TW-55	11/05/92	31.74	Top of PVC casing	5886.33		Top of PVC casing = 2.0' ags
TW-55	11/06/92	31.79	Top of PVC casing	5886.33		Top of PVC casing = 2.0' ags
TW-55	11/11/92	32.21	Top of PVC casing	5886.33		Top of PVC casing = 2.0' ags
.TW-55	12/02/92	31.86	Top of PVC casing	5886.33		Top of PVC casing = 2.0' ags
TW-55	5/20/93	26.40	Top of PVC casing	5886.33		Top of PVC casing = 2.0' ags
TW-55	5/25/93	26.58	Top of coupling	5886.58		Top of PVC casing = 2.0' ags
TW-55	10/23/93	30.94	Top of coupling	5886.58		op of coupling = 0.25' above TOC
TW-56	10/28/92	60.93	Top of PVC casing	5910.00		op of coupling = 0.25' above TOC
				-/10.00	5849.07 T	op of PVC casing = 2.3' ags

LOCATION	DATE	DEPTH TO WATER (ft bMP)	MEASURING POINT (MP)	MP ELEV.	WATER ELEV. (ft)	COMMENTS
TW-56	11/02/92	61.53	Top of PVC casing	5910.00	5848.47	You of Distriction of Distriction
TW-56			•			Top of PVC casing = 2.3' ags
	11/16/92	61.33	Top of PVC casing	5910.00	5848.67	Top of PVC casing = 2.3' ags
TW-56	12/02/92	60.96	Top of PVC casing	5910.00	5849.04	Top of PVC casing = 2.3' ags
TW-56	5/20/93	52.71	Top of coupling	5910.20	5857.49	Top of coupling = 0.2' above TOC
TW-56	5/25/93	52.81	Top of coupling	5910.20	5857.39	Top of coupling = 0.2' above TOC
TW-56	10/26/93	59.14	Top of coupling	5910.20	5851.06	Top of coupling = 0.2' above TOC
TW-57	10/24/92	13.33	Top of PVC casing	5952.54	5939.21	Top of PVC casing = 2.18' ags
TW-57	10/28/92	13.32	Top of PVC casing	5952.54	5939.22	Top of PVC casing = 2.18' ags
TW-57	11/02/92	13.32	Top of PVC casing	5952.54	5939.22	Top of PVC casing = 2.18' ags
TW-57	11/07/92	13.35	Top of PVC casing	5952.54	5939.19	Top of PVC casing = 2.18' ags
TW-57	5/20/93	9.21	Top of coupling	5952.74	5943.53	Top of coupling = 0.2' above TOC
TW-57	5/28/93	9.55	Top of coupling .	5952.74	5943.19	Top of coupling = 0.2' above TOC
TW-57	10/26/93	12.61	Top of coupling	5952.74	5940.13	Top of coupling = 0.2' above TOC
TW-58	11/11/92	31.67	Top of steel casing	5892.74	5861.07	Top of steel casing = 2.9' ags
TW-58	12/02/92	31.74	Top of steel casing	5892.74	5861.00	Top of steel casing = 2.9' ags
TW-58	12/03/92	31.71	Top of steel casing	5892.74	5861.03	Top of steel casing = 2.9' ags
TW-58	12/15/92	31.76	Top of steel casing	5892.74	5860 <b>.98</b>	Top of steel casing = 2.9' ags
TW-58	5/26/93	25.96	Top of steel casing	5892.74	5866.78	Top of steel casing = 2.9' ags
TW-58	10/28/93	30.67	Top of steel casing	5892.74	5862.07	Top of steel casing = 2.9' ags